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AMERICAN JOURNAL OF OPTOMETRY *and* ARCHIVES *of* AMERICAN ACADEMY OF OPTOMETRY

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Established 1924

What Makes a Bifocal Click?

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It Must Be

Thin

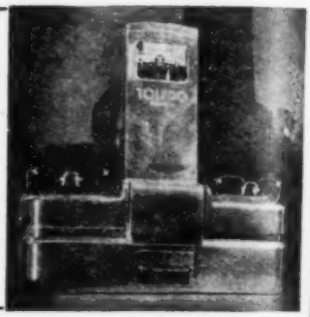
Inconspicuous

COMFORT

This Hinges On

Light Weight

Easy Shifting from One Field to Another



PERFORMANCE

This is Dependent Upon

Full Wide Angle Vision

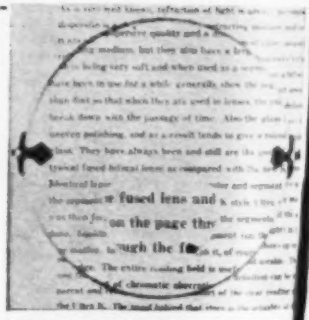
Ample Depth of Perception

Absence of Color Blur

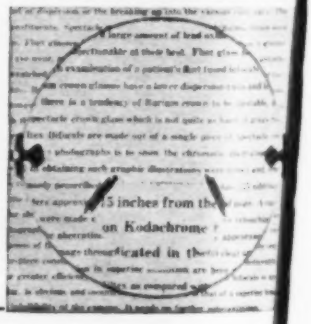
Minimum of Jump

Proper Polish

K ULTEX



ORDINARY BIFOCAL



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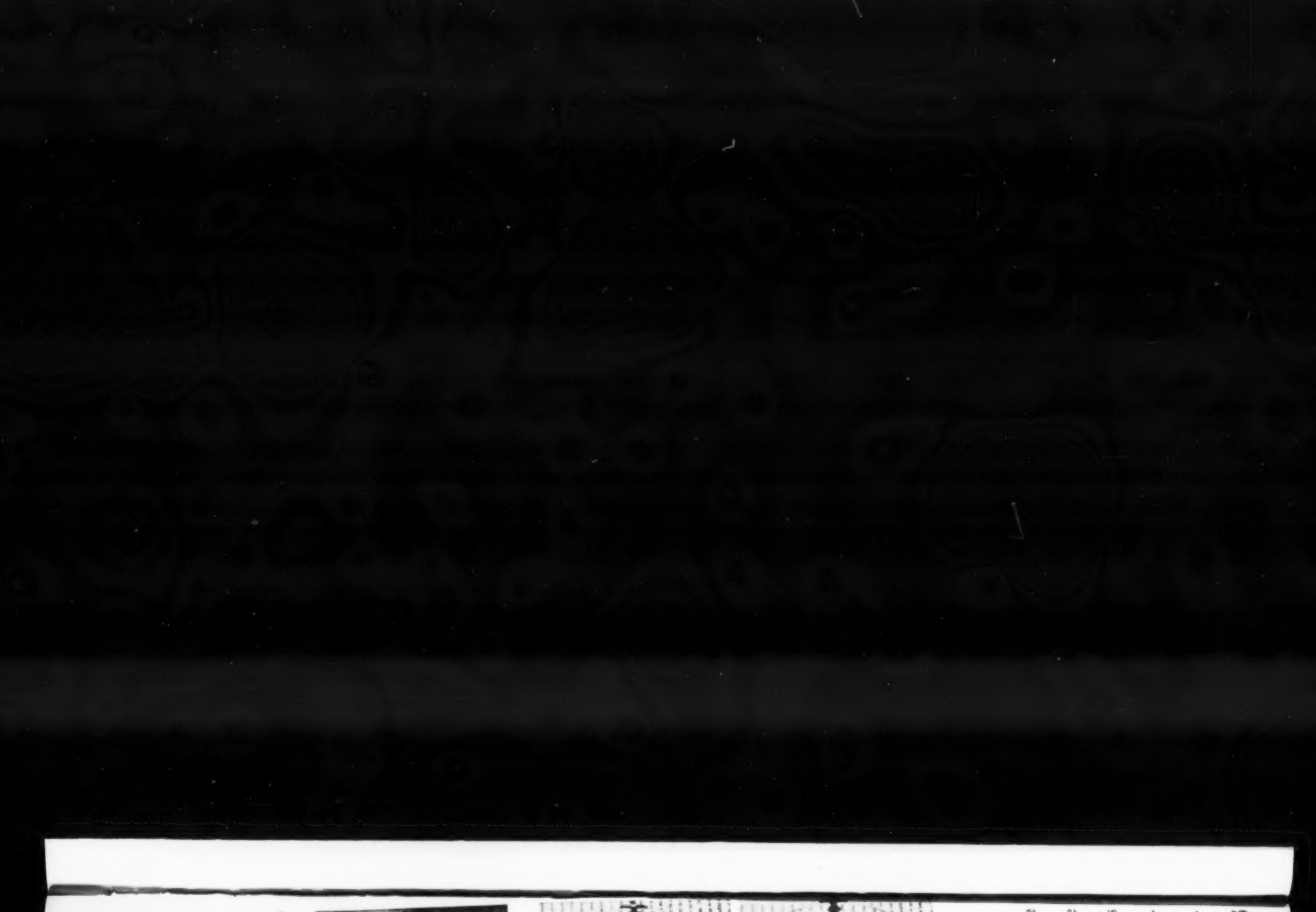

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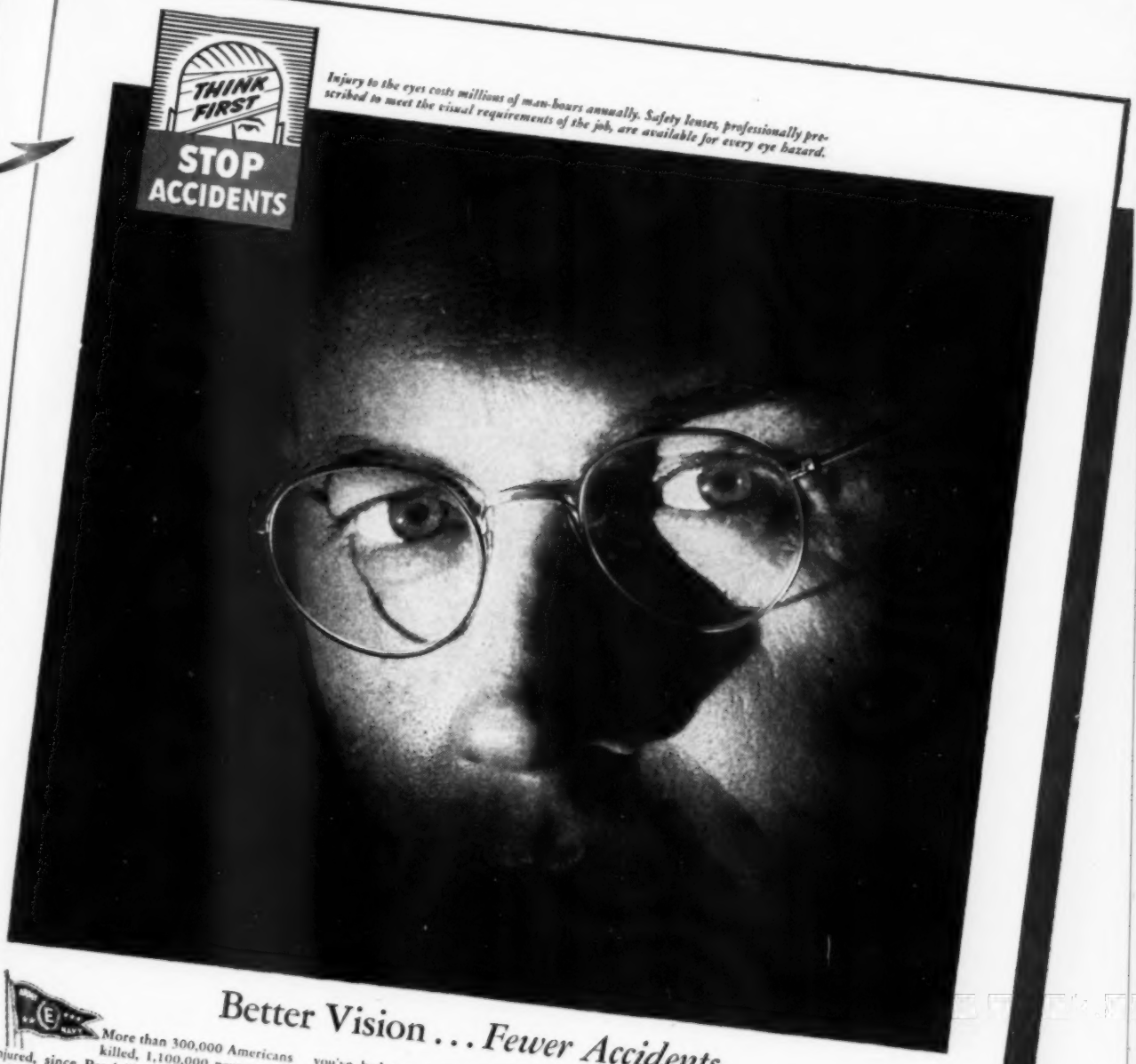
Professional Eye Care as Accident Prevention

Faulty vision contributes to *thousands* of accidents every day. Your skill, used in time, could prevent many such home-front casualties. To awaken the people of your community to your part in the urgent national campaign to reduce accidents, Bausch & Lomb is releasing a series of advertisements on this theme. Shown here is the second of these messages.

Bausch & Lomb Optical Co., Rochester 2, N. Y.

BAUSCH & LOMB

ESTABLISHED 1853



Injury to the eyes costs millions of man-hours annually. Safety lenses, professionally prescribed to meet the visual requirements of the job, are available for every eye hazard.

Better Vision . . . *Fewer Accidents*

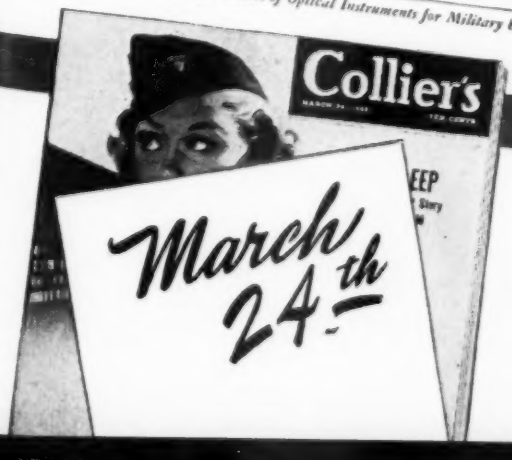
More than 300,000 Americans killed, 1,100,000 permanently injured, since Pearl Harbor—nearly a million and a half casualties *lost on the home front!* Traffic, factory, farm, and home accidents—many of them caused by faulty vision—have claimed more victims in killed and injured than has enemy action.

Reducing this appalling loss is an urgent military necessity. One of the things you can do is to *make sure your vision is up to par.* You will never know just what your visual capacities are until you've had a competent professional analysis. Modern optical science has proved that visual defects handicap many who do not realize it. It's also a fact that the specialized skills required in industry today call for specially-adapted types of vision.

The professional and technical services of optometrists, ophthalmologists, and opticians are available in your community. Through their skills they may be able to increase your working efficiency and earning power, add to your personal comfort, reduce your chances of being involved in an accident. Bausch & Lomb Optical Co., Rochester 2, N. Y.

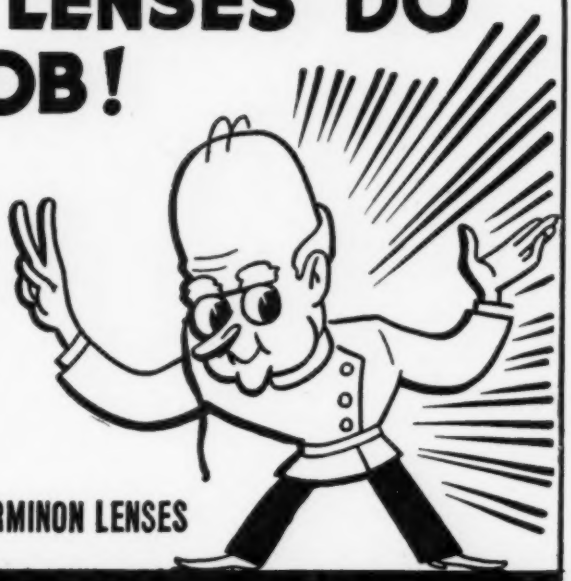
BAUSCH & LOMB
ESTABLISHED 1853

Makers of Optical Glass and a Complete Line of Optical Instruments for Military Use, Education, Research, Industry, and Eyesight Correction and Conservation



A vital thing to look for,
— a safe thing to find!
— no better lens made!"
— saves shop time"
"Customers compliment them!"
— We prefer them to others"
SPH. 4 M/M CYL. +.75
Titmus
PERFEX
CROOKES
TITMUS OPTICAL CO.
PETERSBURG, VA.

THERMINON LENSES DO A *two fold* JOB!

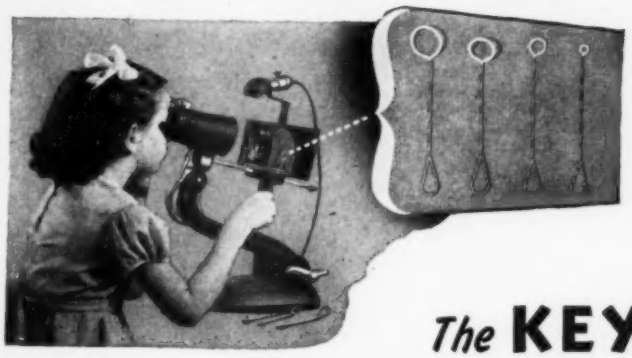


Therminon lenses are new . . . better . . . different because they increase the amount of visual light that is admitted through ordinary tinted lenses and greatly reduce the infra-red heat rays that pass through the white lens.

When you prescribe Therminon lenses, you will be sure your patients are fitted with the finest ophthalmic lens that is available. You'll recognize Therminon lenses by their faint green tint . . . a cool color for a cool lens.

There's Benefit in Better Fit...WITH THERMINON LENSES

THERMINON LENS
CORPORATION
411 Eleventh St. Des Moines 9, Iowa

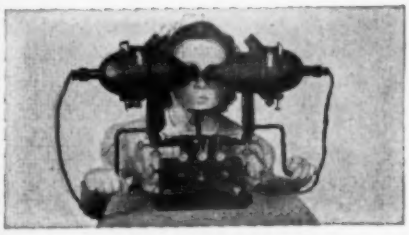


A new approach to the Initial Training of SQUINT

The KEYSTONE *Basic Series*

Equally effective for the development of stereopsis in non-squinters, especially when suppression and amblyopia are disturbing factors.

Write for our informative analytical bulletin "The Keystone Basic Series."



KEYSTONE VIEW COMPANY
MEADVILLE, PA.

Creators of Modern Scientific Aids for Better Vision

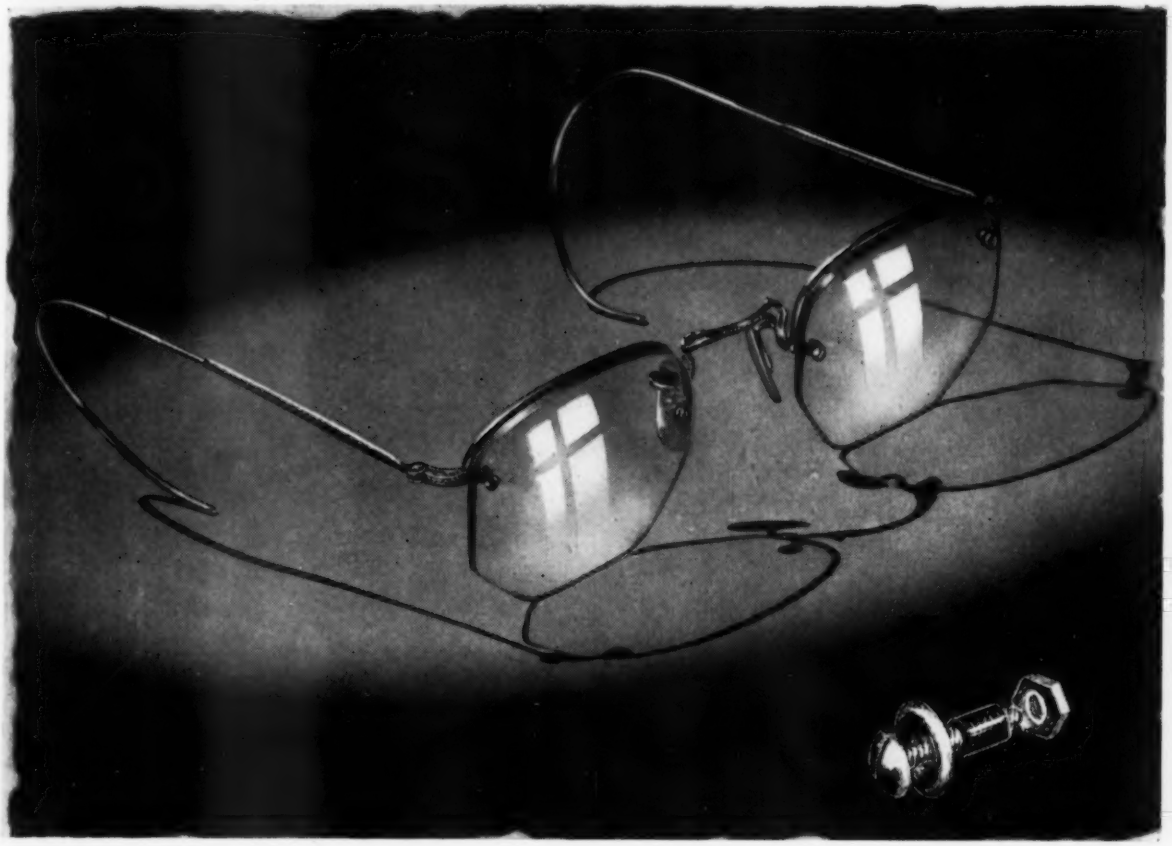
MOVIES PUT KEN IN A COMA
FRED IS A FENDER-BENDER
MENUS ARE MUDDLES TO MIRIAM
DIGITS DANCE FOR CHRIS
D-MINUS DIM-OUT FOR DORA
STELLA S-T-R-E-T-C-H-E-S TO SEE
LET'S SEE—Could one of these be you? . . .
No fooling. If your vision is poor, you too become an "arm-stretcher"—trying to read the hairline markings on a Micrometer . . . the jumble of words on a menu . . . or the numbers mirage in a phone book!!
Or a neck-craner—trying to unscramble the characters in a note book . . . A stare-y eyed student, perhaps, who can't concentrate on her studies and becomes classed as dull and backward.
Maybe you're on the receiving end of a car smash "call"—the one that popped out of nowhere and rammed you—remember? Or maybe you're just a nerve-frazzled, sleepy guy to whom motion pictures are just muddle pictures. And one long, drawn-out headache.
Seriously, you should take care of your eyes. No second pairs are ever passed around. One pair has got to last you a lifetime and do a million and one important jobs for you . . . Jobs that bring you happiness, relaxation, efficiency and the bulk of your knowledge.
So care for those irreplaceable eyes as you would a precious jewel. Your good judgment should prompt you to see an Ophthalmologist or Optometrist at once, and regularly, for a check-up on your eyes and your seeing performance. His professional knowledge and judgment as well as the technical skill of an Ophthalmic Dispenser (Optician) can do wonders in restoring and maintaining your vision at peak level
BETTER VISION INSTITUTE, INC.
630 Fifth Avenue, New York 20, New York
BETTER VISION BVI FOR BETTER LIVING

HITTING THE HEEDLESS

THIS unusual BVI advertisement calls to account the "arm-stretchers" and "neck-craners". The touch is light—but the point is there. The 40 million readers of Life, Sat. Eve. Post, Collier's, American, Farm Journal and MacLean's will not by-pass this diverting portrayal of the drawbacks and hazards of defective seeing...one of the continuous series of thought-provoking advertisements published by the Institute in behalf of its 3500 supporting members, including these manufacturers: American Optical Co.; Bausch & Lomb Optical Co.; Bay State Optical Co.; The Kono Mfg. Co.; Frank Krementz Co.; Optical Products Co.; Shuron Optical Co., Inc.; Soft-Lite Lens Co., Inc.; Titmus Optical Co., Inc.; The Univis Lens Co.; Zylite Optical Co., Inc.

BETTER VISION BVI *FOR BETTER LIVING*

BETTER VISION INSTITUTE, INC. • 630 FIFTH AVENUE, NEW YORK 20, N. Y.



1/10-12K gold filled with 10K gold bridge; also made in highbar.

ENLARGED SCREW ASSEMBLY

SIMPLIFY YOUR MOUNTING PROBLEMS WITH

the *RIMWAY FUL-VUE**

A NEW CENTURY FRAME!

As good for you as for your patients — because in addition to smart flattery, the Rimway Ful-Vue features uniformity of construction, thus simplifying your mounting problems. And Century's complete screw assembly is a safeguard against loosening screws.

The Rimway Ful-Vue, made of the finest materials obtainable, has been acclaimed by the profession. Have you seen it?

PREVENT LOOSE SCREWS by using our *complete* screw assembly, including: screws, washers, plastic tubes, *lock nuts*.

Century **OXFORD MANUFACTURING CORP.**

51-12 21st STREET • LONG ISLAND CITY, NEW YORK

**licensed by American Optical Co.*

DEDICATED TO THE ADVANCEMENT OF PROFESSIONAL EYE CARE

Public Misconceptions
—about Lightning —about Glasses

LIGHTNING CAN STRIKE THE SAME PLACE TWICE

GLASSES ALONE CAN'T CORRECT FAULTY VISION

Records show that in New York City, for example, lightning has struck the same building as many as twenty times in the same year. That old adage about lightning never striking twice in the same place is a misconception.

To think that glasses, alone, can correct faulty vision is also a misconception.

Glasses are important, of course, but your eye comfort and visual efficiency depend upon the professional and technical skill with which your eyes are examined and refracted, your glasses prescribed, your prescription interpreted, your glasses fitted, re-evaluated and serviced.

It is for these professional services —not for glasses alone—that you pay a fee.

Glasses, alone, can't correct faulty vision; what counts most is the professional skill and technical services of your Ophthalmologist, Optometrist, Ophthalmic Dispenser.

Don't be satisfied with anything less than thorough eye care. Seek the professional skill—the services that your priceless sight demands.

Seek professional advice—
not glasses at a price.

American Optical
COMPANY

Founded in 1833 — the world's largest supplier to the ophthalmic professions.

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PROFESSIONAL AND TECHNICAL SERVICES ARE ESSENTIAL TO EYE COMFORT AND VISUAL EFFICIENCY—THE AMERICAN WAY
REFRACTION
PRESCRIPTION
INTERPRETATION

This AO AMERICAN Way message will reach a
of readers through the pages of LIFE, February
THE SATURDAY EVENING POST, April 11th;
April 17th and GOOD HOUSEKEEPING for

THIS NEWEST EDUCATIONAL MESSAGE SHOWS YOU HOW

AO continues its Pioneering Campaign

AO's national educational program "Dedicated To The Advancement of Professional Eye Care" is now in its fourth year. In 1945 this campaign continues its pioneering efforts to correct the public misconception regarding the true relation of spectacles to eye care and visual efficiency. It will continue to pioneer in excluding all references to corrective ophthalmic products by brand-name.

During 1944, AO messages pointed out that in eye care, as in medicine, dentistry and law, it's the professional skill and technical ability that are of prime importance—not the materials used. Readers were clearly told that "the fee you pay is for professional services—don't mistake it for the price of a pair of glasses."

In this year's messages we gain attention by comparing other common misconceptions with the one you and we wish to correct.

The first in this dramatic new 1945 series featured the "blind as a bat" misconception. Now comes number two, disproving the old adage that lightning never strikes twice in the same place. It is a simple and natural step from the correction of these common misconceptions to the correction of the misguided belief that glasses alone can correct faulty vision.

Further to help create a public appreciation of professional and technical services, each advertisement carries illustrations of some of the services essential to eye comfort and visual efficiency. Here is a program truly and exclusively dedicated to the advancement of professional eye care.

ARMY (E) NAVY

American Optical COMPANY

SUCH *Outstanding Dependability...*

is the reason many thousands of careful refractionists specify Riggs Rx Service in filling their prescription needs.

Riggs is proud of this expression of confidence in its Rx Service and constantly strives to remain worthy of it in every prescription.

When you prescribe via Riggs Rx Service you may be sure of high quality, superior service and dependability.

Riggs Optical Company

Distributors of Bausch & Lomb Ophthalmic Products
General Offices, Chicago, San Francisco

BRANCHES IN PRINCIPAL WESTERN AND MID-WESTERN CITIES

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Vol. 22 April, 1945 No. 4

THE OTHER BASTION*

Irvin M. Borish
Kokomo, Ind.

Beginning with the inauguration of the Professional Advancement Program, much time and thought has been expended upon the problem of Optometric Education and upon the structures involved in this function. In many instances, the entire trend of conception has been formulated towards the simple effort of "saving the schools." This article does not propose to contend arbitrarily with this position, but it does plan to object to the general and all-inclusive nature of this appeal, and to raise doubt that the eventual best interests of optometry will be served by indiscriminate and unevaluated attempts to achieve it.

For contrary to the recently expressed opinions of some of our colleagues, Optometry's hope is to achieve the position of a recognized para-medical profession; and the question is not whether Optometry is one or another kind of profession, but whether it can merit a proper place as a profession at all! Despite emotional perorations to the contrary, no such position is attainable unless it is afforded all proper esteem by the recognized fields of science and learning, including Medicine. The fact that individual Optometrists are occasionally granted such esteem proves nothing, for in most instances, such individuals are recognized *in spite of, rather than because of* the fact that they are Optometrists.

Discussion of this subject introduces irrelevancies which merely skirt the subject. Arguments about the nature of the degree, or whether one type of school or another contains a larger commercial element among its graduates, or the fear of medical or other domination, are essentially quibbles or sheer demagoguery. Only half our present schools now grant an O. D. for four years of work. Certain states whose membership is predominantly comprised of men without the O. D. stand as well, at least, as do others comprised mainly of O. D. holders. Detroit and Chicago, containing in the main graduates of one type of school,

*Submitted January 22, 1945.

are as blatant examples of commercialism as is New York, predominated by alumni of another type of school. Present university schools are no more medically dominated than is the profession as a whole.

The fact that the Rehabilitation Program has apparently endorsed our existing schools is not of great significance. This program is concerned essentially with providing training towards the earning of a livelihood. It does not worry too much about whether a candidate selects a trade or a profession, or whether the school which the candidate selects (and selection is left to the candidate) would qualify, in its eyes, as a professional school or a trade school. It is content so long as the course will enable the graduate to pursue a vocation. Its standard of approval, then, is not based so much upon the opinion of the Rehabilitation authorities as it is upon the candidates' eventual acceptance for examination and licensure, or, in the final analysis, upon Optometry's own opinion about its own schools. (In some instances rehabilitants have been sent to schools which Optometry does not actually approve.) This is not recognition or approval by either accepted fields of learning or by the government in the sense in which such approval is sought by many Optometrists.

In actual fact, requirements for further schooling, ASTP programs, Navy V programs, the contemplated industrial vision courses in universities, the requirements for women optometrists in the WAC, all emphasize that much of Optometric education is decidedly not recognized, and hence much of Optometry is not recognized.

Recognition of the profession as a whole necessitates acceptance of not only the expression of the art of the field—the mode of practice—but also of the expression of the science underlying that art—the soundness of its educational system—it well behooves each individual practitioner to arouse himself from his present artificial complacency and to realize that a period of undetermined re-evaluation and reconstruction of our economic order is due to follow, and that our present consideration of these matters may bear paramount influence upon our eventual status.

The writer does not believe that either all the schools can be saved; or that it is to Optometry's best interests, in the light of the necessity for governmental, scientific, educational, and medical recognition, to even attempt to save them all. For while a large amount of new blood is needed, no number of new students even approximating the estimate of the professional Advancement Program can be anticipated and since no profession can afford to ignore the question of the quality of its new blood, it

would be far better to concentrate upon fewer blood banks of tested quality than to adulterate the entire stream by injudicious wholesale transfusions. The total number of students which Optometry gets will be the same whether these are distributed over all the present existing schools, actually benefiting none of them to any great extent; or whether concentrated in a few institutions, enabling these to maintain, at least, the more desirable pre-war standards which all the institutions promised would be maintained, and which promise has been already broken in certain instances.

While Optometry would still get the same total of students, two other desirable objectives could also be attained by selective support. The fewer better schools would receive more students each than otherwise, and would be enabled to better maintain and improve their standards and performance. The elimination of the poorer schools would actually do Optometry a service—for the very existence of such institutions is an exhibition of the low professional level of Optometry, and a threat, in the future, to the quest for recognition in which we are engaged.

The task of organized optometry and of its Council on Education, particularly in regard to depositions made to the government on matters dealing with education, has been made much more difficult because of the mere existence of certain of our educational institutions, principally because, as an agency of the profession, the Council has found it necessary to reflect the apparent position of the profession—that all the so-called recognized schools be bracketed and considered as one, without real attempt to distinguish between their various merits or soundness of educational principles. I think it safe to say that if the Council, with its knowledge of correct procedure and of the existing circumstances, had felt enabled to speak as freely as it might have, the problems involving past, present and future deferment of students would have been simpler of solution.

So much confusion has existed in the minds of various bodies and individuals who have become concerned with optometric education, that in many instances emphasis has become completely misdirected, so that mere fulfillment of time requirements, or of sketchily drawn syllabi of instruction have become interpreted as signifying compliance with recognized educational standards. It is essential that the great body of optometrists become acquainted with what is proper in an accreditable educational institution, not only in Optometry, but in all branches of learning. When the writer discriminates between stronger and weaker schools,

or better and poorer, he is pointing to other than merely obvious factors: equipment, number of faculty, or size of student body, for physical facilities can be built, altered or destroyed; faculty, hired or fired; student bodies, grow or diminish.

The essence of educational integrity, and the first point of investigation by any agency of accreditment, is the ability of the institution to proceed upon sound principles and to fulfill its obligation of educational integrity—*as reflected by the mode of its administrative and organizational structure!* An administration so constructed as to honestly achieve the aims of true education, will supply all the rest; an institution unsoundly organized can waste the best facilities conceivable.

The particular onus which Optometry bears in regard to educational pursuit is that it is among the very new fields, and these are usually catalogued as "cultist" fields, in which *proprietary* institutions still hold sway. Assuming that Optometry has no desire to be classed as a cult and wishes to take its rightful place among the professions, the cultured, and the learned, the educational situation places the entire field in as paradoxical a position as does the discrepancy between how the profession is practiced in certain instances and the offices held in local and state associations by those practitioners. Because of these factors the Council must ignominiously attempt to excuse or conceal the existence of these institutions from the knowledge of those (particularly in government) who are both versed and astute in these matters.

As matters now stand, no other recognized rating body will favorably accredit a proprietary institution, and since no university can exist without such accreditment, all universities are non-proprietary institutions. Also, all independent colleges which are accredited by regional or professional agencies are likewise non-proprietary, whether in the fields of science, technology, medicine, dentistry, engineering or library science, with the exception of Optometry and the forementioned "cult-fields." Can anyone with sound knowledge of education in any field be blamed for drawing an obvious inference? But, in Optometry, we are being asked to not only continue to condone the existing situation but to actually help preserve it!

The terms "proprietary," "private," "independent," et al, have been bandied about with such disregard of their accepted meanings in the accrediting sense, that an attempt is here made to clarify them so that all individuals in Optometry who are sufficiently interested may more properly distinguish one from the other.

An institution, whether a university or a college, which derives its income from tuition fees, endowments, investments, or a church of a particular denomination, but is assisted by no funds from the municipality or state, and whose administration is responsible in no direct way to an agency of the municipality or state, is a *private* institution. Private universities include Harvard, Columbia, Chicago and Notre Dame, while Wellesley and Dartmouth are examples of private colleges.

An institution which derives all or part of its income from state or local funds, and whose administration is finally responsible to a legislative or other similar body, is a *public* or *state* or *city* school. Minnesota, Illinois, Ohio State and City College of New York are such institutions, as are most state teacher's colleges and schools of mining and agriculture.

An institution whose administration falls under a superior administration of a larger body of which it is a component is an *affiliated* school. Colleges of arts and science in universities, or specialized colleges such as medicine or law when part of universities, are such institutions. Examples include the Medill School of Journalism of Northwestern University, the Graduate School of Princeton, the Post-Graduate Medical School of Minnesota, and so forth.

An institution which is not so associated is an *independent* school. Carroll College is an example, as is Jefferson, Hahnemann, and Women's Medical among medical schools.

None of the above have anything to do with the question of whether the institution is proprietary or not, nor are any of the above of more than academic interest to accrediting agencies when ratings are determined. But what is of moment, and what is usually meant when criticism is directed towards "private" schools, is whether or not the institution is proprietary.

It is perhaps easier to explain how a proprietary school may be recognized by first describing the usual form of organization of a non-proprietary institution.

The fact that an institution may be chartered as a so-called "non-profit" institution may be totally disregarded. That constitutes the State's feeble attempt to keep the path of education clear—the recognition of the State that private interests and education do not go together—but a non-profit charter is easily obtained and as easily subverted. Not only educational institutions but even charitable institutions of very doubtful character can often boast of non-profit charters.

A true non-proprietary school is distinguished by the following essentials of its administration:

1. The final resort of control rests with a Board (of Trustees, Regents, or Directors) which is comprised of individuals first elected by the original holders of the charter, and which is perpetuated by periodical re-election or replacement of its members.

The terms of service of the members are specifically stated.

2. No member of this Board receives any salary of any sort for his services on the Board. The men chosen are usually prominent in as diverse fields as possible, and are chosen for their standing in industry and science and for their devotion to the cause of education.

3. No member of the Board, with the exception noted immediately following, can occupy any *other position* in the institution, whether in an administrative or teaching capacity, or *receive any salary for such services.*

4. Since it is desirable that the faculty be represented on the Board, the exception customarily made to the above permits the election of the President of the institution to the Board. This is not always done—in some cases some other faculty member or administrator is chosen instead of, and in a few cases, in addition to, the President. The term of the President is determined, continued or terminated in the same manner as that of other members of the Board. He receives only a salary as President, not as a Board member.

5. The budget of the institution, and the salaries of the President and all other administrative and faculty posts are established by the Board.

6. The President is appointed by the Board, is responsible to the Board, and is bound by written contract with the Board. He may, within the terms of that contract, be fired or re-hired or replaced at the expiration of a given term.

7. The Board meets periodically, usually each year, and the President is required to submit a comprehensive account of the state of the institution, including a history of the period expired since the last meeting, suggestions for plans and policies for the future, and estimates of the budget, etc., for the next period. In all reputable institutions, such a report, as are all records, is available for public inspection.

Since salaries and the budget are reasonably set, and since no member of the Board, except the President, and then for his post as President and not as a Board member, receives any compensation from the institution, there is no appeal to any individual's cupidity. Since there is no one to whom a profit can go, there is no attempt to garner such a profit by avoiding the full responsibility of an educational institution to its students. The Administration can concentrate upon expending the total income in the most efficient manner towards supplying the best possible educational advantages to the student; towards reducing debts, if they exist, of the institution; and in increasing the institution's value to its specific field or profession and its community. If surplus funds accrue, more and better teachers can be employed; good teachers can be provided with the additional opportunities for increasing their skill which a reputable institution should have available; newer and better facilities can be provided. If a surplus still tends to accrue and the number of students seems to be increasing, either still more teachers can be secured and still more facilities, or the institution, as is generally done, can restrict its enrollment and concentrate upon a higher quality rather than an increased quantity. In any event, the student is guaranteed, in such a school, that every dollar which he pays in tuition fees will be expended upon his education, and where an endowment exists, even more.

The proprietary school ordinarily presents a directly contrary administrational structure, although usually every attempt is made to denote the surface appearance of the legitimate institution. However, certain distinct differences are obvious:

1. The charter usually centers complete control in the proprietor.

2. A Board of Directors usually exists, but it is responsible to the proprietor (or President), rather than the reverse. The proprietor usually has the power to replace or appoint the Board members. Where greater similitude to the non-proprietary school is desired, the Board may have nominal control, but in that case is usually packed with either relatives or close friends of the President's.

3. The members of the Board either receive compensation for their services on the Board, or hold administrative, faculty or contracted positions in the institution, for which they receive salaries or payment.

4. The terms of members of the Board are indefinite, and if definite,

without significance, since records show that changes in personnel are either rare or entirely by caprice.

5. The salaries of the President and other personnel are subject to fluctuation; contracts are seldom employed; no salary scale is definitely determined (so that a full professor in one department may receive less than an instructor in the same department, or a librarian more than the Dean); and faculty records will usually show a high and consistent turnover of faculty personnel—leading to little stability of even the instructional standards. The whim of the proprietor is supreme.

6. The President need make no formal report to the Board (under the circumstances such would be farcical) and records of the institution are rarely, if ever, available to public scrutiny.

Since the owners of such institutions are frequently aware of the deficiencies of such an organization, attempts are sometimes made to present a more decentralized appearance of the administration. These often take the form of the creation of advisory councils, selected by the administration, and fulfilling the appearance of the legitimate Board in that the members serve without compensation, but differing in that they have no authority whatsoever, and in that they exist as separate entities along with whatever Board is established. The personnel is usually so widely scattered that meetings are impossible, and if it did meet would have no program for action. The members have usually been selected upon some personal basis, without consideration of their qualifications for the posts, and can be replaced, as they were selected, by the proprietor of the institution. As they have no authority, they can serve no useful purpose but that of convenient scapegoats, when needed, for the true administrators of the institution. Such councils are not to be confused with the legitimate advisory councils usually elected by alumni associations to give aid and support to some legitimate institution. These latter are neither appointed by nor responsible to the administration of the school.

It can be readily seen that a proprietary administration is bound by no educational restrictions, and need admit no obligation to the field from which it draws its support. A proprietary school could, conceivably, offer as good a course as a non-proprietary one. A proprietor could be so devoted to his profession's welfare, so truly concerned with the philosophy of honest educational endeavor, that his institution would meet every condition of a non-proprietary one. But so able and unselfish an

administrator should certainly be aware of the stigma of the proprietary connotation, and if so devoted to the best interests of his profession, and so model an exponent of self-abnegation, would have no hesitancy in rechartering his institution along non-proprietary lines. Yet some in our profession seem exceedingly reluctant to take this step voluntarily. Only one or more of the following reasons can be offered for their hesitancy. Ignorance of the correct procedure—in which case, there might arise some doubt as to the professed knowledge of education and ability of the proprietor; fear that he will be unable to hold his position under reorganization—in which case, he has no more moral right to head a proprietary than a legitimate school; or simple self-interest—in which case he has no claim to the support of the profession. No student, father or state association has any real guarantee that the money they pay in will not be diverted from educational expenditure. Only faith in the integrity of the proprietor can balance the assurance which the non-proprietary organization gives.

The North Central Association and other regional associations The Council on Education of the American Medical and Dental Association, and all similar agencies, have devoted years to the investigation and study of these matters. They refuse to accept the existence of such altruism in their own institutions, and I doubt that they will ever accept it in Optometry's.

The writer summarizes his position as follows:

1. Except by unpatriotic or other deceptive measures, Optometry cannot secure at this time more than a very modest fraction of the new students it needs.

2. This small number if spread over all the existing institutions, will assist none of them materially, but if concentrated in the fewer better schools, will be of real value in saving Optometry's educational structure.

3. Certain of our schools, by being proprietary, tend to bring discredit upon the profession, and do not deserve the profession's support.

4. No other field of recognized learning condones, recognizes or nourishes proprietary schools. Those fields which do are known as quack or freak cults, and Optometry does its cause little good by aligning itself with them.

5. Organized Optometry has no right to ask its constituent members to support or contribute to those institutions which reflect in a doubtful manner upon the profession and which constitute a stumbling block in Optometry's path toward final recognition.

6. The Council on Education has a duty to every member of the profession and to those honorable institutions which might be mistakenly maligned by the uninformed. That duty is to clearly indicate the accurate status of the schools of optometry, so that the members in the field may throw their support in the proper direction.

7. Selective support, as is herein advocated, will better support the deserving schools, help eliminate the questionable ones, and thus do the profession two services at the same time.

A profession which plays "ostrich" with its own defects can only expect to be considered too ignorant to be aware of them, or too irresponsible to care about them—in either case, scarcely deserving full professional stature.

Medicine suffered a rejuvenation when its schools were reduced by half following the Flexner report, and for reasons identical with those facing Optometry today. Veterinary Medicine stands today with increased vigor and prestige, despite the fact that the last war saw the elimination of almost all of her schools—including all the proprietary ones.

Optometry cannot afford to have an exposed Achilles heel. It has serious problems today and will have perhaps more in the post-war readjustment to come. Its leaders have no right to call upon the members to donate to and support a scholarship program which is indiscriminately applied so that it may thereby succor the very problems in its educational system. Optometry cannot directly force such institutions out of business, but it can refuse to support and nourish them. It can strengthen the protestations of its representatives in Washington by removing one of the causes of these representatives' embarrassment. It can save and develop its better institutions by concentrating its energy upon them. A sound half loaf is still preferable to a moldy whole one. And, if after the war more institutions are needed, such institutions can be presented with examples so that their founding may be upon a sound basis, and in such a manner that credit is brought to the profession. For it is easier to establish proper new institutions, when a real need arises, than it is

to correct the bad habits or live down the besmirched heritage of an unsound existing one.

It has been frequently propounded that the progress and future of our profession depend upon twin bastions of educational advancement and professional practice. Much effort is being expended in publicizing our defects (to ourselves) and in offering solutions for the latter. Does not the other pillar merit equal consideration?

The proprietary school in Optometry, if Optometry is ever to secure full professional stature, is doomed eventually. It is an absurdity for optometrists to be called upon to salvage institutions which they must ultimately cast off, and perhaps sooner than can be foreseen, and to so waste their time, effort and money. At the same time, it is absurd to endanger by dissipated assistance the existence of those schools which the profession must continue to have and which can serve as models for new ones, when needed. If the educational structure of our schools is vital to our profession, then the Council should be obligated to deal with it adequately; the members of the profession should be fully and accurately informed; and the profession's support should be segregated to those institutions which best serve the aims of professional advancement.

ON ASTIGMATISM*

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PART II. LIMITATIONS OF OBJECTIVE TESTS

Ophthalmometry.
Effect of Posterior Surface of Cornea.
Residual Astigmatism in Aphakia.
Astigmatism of the Crystalline Lens.
Interpretation of Ophthalmometric Readings.
Distance of Spectacles From Cornea.
Retinoscopy.

In the first article of this series we presented the evolution of various objective and subjective means of measuring astigmatism. This part of the series will be devoted to a discussion of some of the values as well as some of the shortcomings of ophthalmometry and retinoscopy as objective methods of determining astigmatism. In papers to follow we shall discuss various subjective tests for astigmatism and the effect of cylindrical spectacle corrections on the retinal images.

OPHTHALMOMETRY

The ophthalmometer is an instrument designed to measure the curvature of the front surface of the cornea by utilizing reflected images; that is, the cornea is considered as a mirror and its radius of curvature is determined. The refracting powers of the whole cornea for the different radii are calculated by assuming a certain index of refraction and the ophthalmometer is calibrated in these calculated values of the total refracting power of the cornea. It is quite obvious that the indices of the cornea and the aqueous play an important role in the determination of the refracting power of the cornea. It is reasonable to assume that there are variations in the indices of the cornea and aqueous in different individuals in much the same way as there are in the other constants of the eye. Krause[46] who measured the indices of refraction of the various media of twenty eyes found considerable variations. Undoubtedly, age causes a change in the structure (and therefore in the index) of the human cornea much the same as that which occurs in other tissues. Such

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a deviation from the standard might be responsible for part of the differences between the ophthalmometric and the total astigmatism in any individual case.

Another factor that affects the amount of astigmatism found, is the zone of the cornea utilized in the measurements.[47] The ophthalmometer does not measure the total area of the cornea utilized in vision, but only a zone of about 2.5 mm.[48] in diameter, whereas the average pupil is 3.5 mm.[41] in diameter. It is also possible that the eccentricity of the pupil with respect to the corneal axis might be responsible for some of the differences between the ophthalmometric and the other objective and subjective means of detecting astigmia.

It must be realized that while ophthalmometric findings do provide important data as to the astigmatism of the cornea, there are other surfaces and media of the eye which are effective in modifying the astigmatism produced by the front surface of the cornea.

CALCULATED EFFECT OF POSTERIOR SURFACE OF CORNEA

As stated previously, the ophthalmometer, although it measures only the curvature of the anterior corneal surface, is calibrated to read the refracting power of the whole cornea. This transformation is made by neglecting the cornea altogether and considering that the rays are reflected at the aqueous. That is, the cornea acts just as a membrane to hold the aqueous in place and to give curvature to its surface. Most present day ophthalmometers[48], accordingly, use 1.337 (index of aqueous) for their calibration instead of the accepted value for the corneal index of 1.376[41]. As the index of the aqueous is lower than that of the cornea, the refracting power determined in this way will be less than if the corneal index were used. The reading of the ophthalmometer is thus lower, and more nearly similar to that of the whole cornea—where the back surface acts like a negative lens reducing the total power. While discussing the optical system of the eye, Tscherning[49] (p. 40) stated:

> "The posterior surface of the cornea has up to the present been neglected by authors; we see that it has a certain importance. Its value is negative and almost as great as that of the anterior surface of the crystalline lens. We shall see that it seems to play a part in certain forms of astigmatism.
>
> "Nevertheless, we commit only a small error by neglecting it, that is to say, by supposing that the substance of the cornea does not exist; the anterior surface simply separating the air from the aqueous humor. By eliminating the negative influence

of the posterior surface, the total refraction of the cornea should increase, but the power of the anterior surface diminishes nearly as much, since we replace the index of the cornea by the weaker index of the aqueous humor . . ."

Considering the approximations made in the calibration of the ophthalmometer it is remarkable that the readings are so dependable. We shall endeavor to show with an example that the amount of astigmatism determined in the usual way by the keratometer (using the index of the aqueous for the calibrations) is almost equal to that calculated by using the true corneal index and making allowance for the posterior surface of the cornea.

If the cornea measures 43.00 D. in the horizontal meridian, and 46.00 D. in the other (vertical), we say there is 3.00 D. of corneal astigmia with the rule. Utilizing the index with which the ophthalmometers are calibrated[48] we determine the equivalent radii of the front surface of the cornea by the formula:

$$F = \frac{n' - n}{r} \qquad \text{and we find that}$$

Horizontally: $43\ D = .337/r_h \quad ; \quad r'_h = 7.83$ mm.
Vertically: $46\ D = .337/r_v \quad ; \quad r_v = 7.32$ mm.

The difference between the radii is approximately half a millimeter.

To obtain the true curvature of the front surface of the cornea one must convert the radii into diopters utilizing the accepted value[41] of 1.376 for the corneal index.

$Fh = .376/.00783 = 48.02\ D$ (horizontally)
$Fv = .376/.00732 = 51.37\ D$ (vertically)

Now let us suppose that the radii of curvature of the back surface of the cornea would vary by the same amount: namely, one radius would be half a millimeter longer than the other. Taking Gullstrand's[50] value for the radius of the posterior surface of a cornea of 43 D. as 6.8 mm., the other radius would be 6.3 (½ mm. less). Let us find the powers equivalent to these radii:

$F = (1.336 - 1.376)/.0068 = -5.88$ horizontally
$F = -0.04/.0063 = -6.33$ vertically

The difference between the powers of the principal meridians of the posterior corneal surface is almost half a diopter (0.45 D.), against the rule in this case.

Using these values for the curvature of the front and back surfaces of the cornea and the accepted thickness of the cornea at the pole[50] (t = 0.5 mm.) we can calculate the total power in each meridian utilizing the formula[51] for a compound system.

$$F = F_1 + F_2 - \frac{t}{n} F_1 F_2$$

$$48.02 - 5.88 - \frac{.0005}{1.376} (48.02) (-5.88) = 42.24 \text{ (horizontally)}$$

$$51.37 - 6.33 - \frac{.0005}{1.376} (51.37) (-6.33) = 45.15 \text{ (vertically)}$$

The difference between the combined powers of the two meridians is the amount of astigmatism present; in this case 2.91 D. This compares favorably with the amount of astigmatism read off the keratometer: 3D.

These calculations show that the astigmatism contributed by the posterior surface of the cornea can be a sizeable component of the total astigmia of the eye, especially in cases of high astigmatism. Assuming, as in the above example, that the corneal curvatures vary proportionately, the keratometer gives a high enough approximation to the total astigmatism caused by the whole cornea, even though it utilizes a fictitious index and ignores the posterior surface of the cornea. The errors introduced by neglecting these two factors cancel each other and the result is of enough accuracy to be of clinical value. However, there may be some individual cases in which the curvatures of the anterior and posterior corneal surfaces vary independently. In such cases, some of the differences between the keratometer findings and the total astigmatism may be explained by the effect of the posterior surface of the cornea.

Nicoletti[52] made similar calculations in which he assumed that the radii of the front surface of the cornea remained constant while those of the posterior corneal surface varied by definite amounts. He concluded that an adequate explanation for some of the differences between the

keratometric and the subjective astigmatism is the effect of the posterior surface of the cornea.

We want to stress the fact that the posterior surface of the cornea is by no means a negligible entity in the total astigmatism of the eye, even though some consider that because of the slight difference in index between the cornea and the aqueous the effect of this surface is neutralized entirely.

Tscherning[49] measured with his ophthalmophakometer the curvature, position and thickness of the refracting media of some eyes. His results for the cornea (in diopters) were:

	Mme T.	Dr. B.	M.V.
Thickness of Cornea	1.15mm.	1.06mm.	1.31mm.
Anterior Surface of Cornea			
Radius —Horizontal Meridian	7.98mm.	7.78mm.	8.29mm.
—Vertical Meridian	7.60	7.90	8.33
Refraction—Horizontal Meridian	47.24D.	48.46D.	45.48D.
—Vertical Meridian	49.60	47.72	45.26
Astigmatism—	2.36d	0.74i	0.22i
Posterior Surface of Cornea			
Radius —Horizontal Meridian	6.22mm.	5.66mm.	6.17mm.
—Vertical Meridian	5.55	5.11	5.87
Refraction—Horizontal Meridian	—4.73D.	—5.19D.	—4.77D.
—Vertical Meridian	—5.30	—5.76	—5.01
Astigmatism—	—0.57i	—0.57i	—0.24i

d stands for direct astigmatism (with the rule); i for indirect (against the rule).

Concerning these results he commented:

> "The vertical meridian of the posterior surface of the cornea presents a more pronounced curvature than the horizontal meridian . . . I have also met the same deformity in other eyes which I have measured, so much so that there is reason to believe that the condition is general. It is a deformity analogous to that which, in the case of the anterior surface of the cornea, produces astigmatism with the rule; but, as the posterior surface acts like a concave lens, this deformity produces astigmatism against the rule. It is probably for this reason that eyes, which have no ophthalmometric astigmatism,

generally have subjective astigmatism against the rule. The influence of the posterior surface of the cornea must correspond partly with the term *k* [see below] of the formula of Javal."

RESIDUAL ASTIGMATISM IN APHAKIC EYES FITTED WITH CONTACT LENSES

A novel way of determining the influence of the posterior surface of the cornea on the total ametropia would be to study the residual astigmatism, if any, in a number of aphakic patients who have been fitted with contact lenses. This eliminates the anterior surface of the cornea and, of course, the crystalline lens, as astigmatic surfaces. If there is any residual astigmatism, we are justified in ascribing it to the posterior surface of the cornea.* We have measured eight aphakic eyes in this manner; and the results of this study are given in *Table I.*

TABLE I

Showing the residual astigmatism in aphakic eyes corrected with a spherical contact lens.

Patient	Ophthalmometric Astigmia	Subjective Astigmatism (15 mm. from cornea)	Spherical Correction	Calculated Astigmatism At Corneal Plane
W.C.	—0.75 x 105	—0.50 x 90	+12.50	—0.75
A.S.	—0.50 x 150	nil	+10.00	nil
T.P.	—3.75 x 165	—1.50 x 90	+13.00	—2.25
A.N.	—6.50 x 80	—0.25 x 90	+13.00	—0.38
H.K.	—1.25 x 150	nil	+12.00	nil
A.P.	—5.50 x 25	—1.00 x 75	+13.50	—1.54
A.S.	—0.50 x 150	nil	+10.00	nil
G.C.	—1.50 x 100	—0.25 x 90	+12.50	—0.37

While no general conclusions can be reached from a study of eight cases only, it is interesting to note that three out of the eight cases showed no residual astigmatism while wearing a contact lens on the aphakic eye. However, five out of the eight cases showed a residual astigmatism ranging from a quarter of a diopter to one and a half diopters *against the rule* in all cases. In these five cases we may conclude that the astigmatism remaining in the aphakic eyes fitted with contact lenses is due *only* to the effect of the *posterior surface of the cornea.*

*Some believe that there might be an astigmatic effect caused by the contact lens itself—such as by its weight or lag, pressure on the globe, etc.

The subjective methods of examination utilized in this study included a distance set of astigmatic dials and stigmatoscopy*, and the measurements are ±0.25 D.C. Inquiries were made of several men who have had considerable experience in fitting contact lenses to aphakic as well as non-aphakic eyes and we have not been able to obtain data similar to those herein presented. The reason probably is that those who are engaged in contact lens fitting are usually not concerned with finding the maximum residual astigmatism with contact lenses but are more concerned with obtaining satisfactory vision with a spherical correction. Arno E. Towne[53] discussed three cases of monocular aphakia in which he achieved binocular vision using spherical contact lenses on the aphakic eyes. Similar cases[54] which have been corrected at the Dartmouth Eye Institute were not given a cylindrical correction in the contact lenses even though some residual astigmatism, as indicated in Table I, was found. Although the number of cases presented is small it is interesting to note that this original clinical method of using contact lenses on aphakic eyes, to determine the role of the posterior surface of the cornea in the production of astigmatism, indicates a sensible and convenient way in which many practitioners may cooperate in adding data on the importance of the posterior surface of the cornea.

ASTIGMATISM OF THE CRYSTALLINE LENS

The crystalline lens may be the seat of additional astigmatism. This astigmatism may be caused by non-sphericity of its surfaces, obliquity to the visual axis or sectional accommodation. Another possible cause of astigmatism inherent in the lens itself is the fact that the index of refraction as it varies from the periphery to the nucleus may not vary equally in all sections.

Tscherning[63] studied the position of the crystalline lens in the human eye by observing the Purkinje images. He reported:

> "From the observations made on a certain number of persons one can conclude that, except for rare exceptions, the axis of the lens never coincide with the visual line. The principal deviation is such as would be caused by rotating the lens about a vertical axis, the nasal side forward. In the eyes I examined, this deviation varies between 3° and 7°.
>
> "Also the axis of the lens is not in the same horizontal plane as the visual line, but is as if the lens had been rotated

*The technique of stigmatoscopy will be discussed in Part III of this paper.

about a horizontal and transversal axis. Usually the top part is forward. This deviation is smaller than the other. In the eyes examined up to now it varies between 0° and 3°.

" . . . The first deviation would cause a small astigmatism against-the-rule—the meridian of highest refraction being the horizontal. But as the corneal astigmatism is usually of the opposite kind, they partly compensate each other.

"When the second deviation of the lens is marked, it causes a change in the position (axis) of the meridian of highest refraction, which becomes oblique."

Sectional (or meridional) lenticular accommodation has been a controversial subject for many years. Dobrowolski[64] in 1868 presented this theory. Many claims for meridional lenticular changes are purely conjectural. Duke-Elder[41] writes:

"There is, however, no scientific foundation for the claim that the accommodation of the ciliary muscle deforms the lens unequally on different meridians . . . All the evidence goes to show that if any part of the ciliary muscle contracts in life, it contracts equally all round."

Lancaster[65] has demonstrated in a practical way that it is not necessary to assume sectional lenticular accommodation in order to explain the apparent ability of some people to compensate for their astigmia, because it is possible, by a *spherical* adjustment of the crystalline lens, to re-focus an astigmatic bundle of rays in such a way as to have fall on the retina, the circular section of the interval of Sturm[12] and thereby make it seem as though the object rays are non-astigmatic.

Evidence that meridional lenticular accommodation can occur has recently been presented by Morgan, Mohney, and Olmstead in their paper "Astigmatic Accommodation."[66] They investigated the nervous control of the accommodation in animals (cats, rabbits, dogs, guinea pigs, rats, and monkeys). The refractive condition was determined by retinoscopy, by photographs of the Purkinje-Sanson images and by measurements of the profile of the cornea and the lens. They found in about 85% of their subjects upon stimulation of the cervical sympathetic nerve, an "accommodative astigmatism" which averaged slightly over one diopter with-the-rule. If we can assume that these observations on animals are applicable to human beings, there is another factor to be considered in prescribing astigmatic corrections.

INTERPRETATION OF OPHTHALMOMETRIC READINGS

In 1890 Javal[55, 56] published a rule for computing the expected subjective astigmatic correction from the ophthalmometer findings. This rule was expressed as follows (Ref. 55, p. 131):

$$\text{Ast.}_{\text{total}} = k + p\ (\text{Ast.}_{\text{corneal}})$$

where k is approximately 0.50 D. (against-the-rule)

where p is approximately 1.25

Javal made clear that his rule was empirical: that the constants *k* and *p* were only approximations. He pointed out that additional terms might have to be added in order to include such factors as age, accommodation, and spherical error. Javal explained that the formula was for cases in which the corneal astigmatic axis differs but slightly, if at all, from the horizontal or vertical. Furthermore, it is evident from his writings that he used minus, rather than plus cylinders*. Javal's own words are interesting not only for their scientific value but because they depict the humility of a great man:

> "I propose, as a meritorious work, the correction of the empirical formula, which must be considered as provisional" . . .
>
> "It is up to the clinicians to modify it by the sincere observation of a great number of facts. It behooves them, similarly, to determine more precisely the relations between the axes of total and corneal astigmia."

It is somewhat unjust to criticize Javal's rule as being inexact when one realizes that Javal himself presented his rule with a statement of its limitations and a proposal that it be modified after further study.

Since the time of Javal other rules and ways for interpreting the ophthalmometric findings have been proposed. Some of these may be described briefly:

(a) Sutcliffe's Rule[57]: For with-the-rule astigmia, using minus cylinders, add one-half the amount of the corneal astigmia to itself and deduct one diopter. For against-the-rule astigmia, using minus cylinders, add one-third to the astigmatism indicated by the keratometer.

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*He says in Ref. 55, p. 53: "For over a year, almost without exception, I have not made any use of convex cylinders" . . . "To prevent errors, the simplest thing is to use exclusively concave cylinders for the measurement and prescription of lenses . . ."

(b) O'Shea's Rule[58]: The corneal astigmatism plus one-half diopter against-the-rule (allowance for internal physiological astigmatism) is added to the spherical "corneal equivalent" ametropia and both are modified by a calculated table to determine their values when placed 15 mm. from the cornea.

(c) McCulloch's Rule[59]: In with-the-rule cases, add one-eighth of the corneal astigmia reading to itself and subtract 0.75 D.; in against-the-rule cases add one-eighth of the corneal astigmia reading to itself and add 0.75 D.

(d) Ryer and Hotaling's[60] method consists in finding the cylindrical lens, set at the wearing distance before the eye, through which the ophthalmometer indicates a half-diopter with-the-rule astigmia. This lens with its axis rotated 90° represents the correction of the total astigmia.

(e) Neumueller[61] made a study of the effect of the spherical error on the correcting cylinder (placed 15 mm. from the cornea) as determined by the ophthalmometer. For low ametropias the effect is negligible. In cases of myopia the correcting cylinder will be more than the ophthalmometer readings; when combined with hyperopia the cylinder will be less than the ophthalmometer findings. Neumueller also studied the effect of physiologic astigmia in cases where the ophthalmometer indicated oblique axes. In this case the axis of the correcting cylinder will be between the corneal axis and 90° (all astigmatic corrections being in minus cylinders). The smaller the corneal astigmatism relative to the physiologic astigmatism, the more will the axis of the correction cylinder deviate from the axis determined by the ophthalmometer.

These rules and means of interpreting the corneal astigmatism as measured by the ophthalmometer should be considered merely as guides and one should not expect to prescribe from them without the verification of subjective tests. Mote and Fry[62] compared the subjective findings with the ophthalmometer readings corrected in accordance with Javal's rule; their study included 200 eyes the astigmatism of which varied not more than 10° from the vertical or horizontal. They found a close agreement between the *statistical* averages for the two determinations but, since differences in *individual* cases amounted to as much as 1.50 D., they conclude that the ophthalmometer findings alone, even

when modified by Javal's rule, cannot be relied upon for determining the prescription in individual cases.

DISTANCE OF CORRECTING CYLINDER OR SPHERO-CYLINDER FROM CORNEA

Another very important aspect in considering ophthalmometric readings is the factor of the distance from the cornea of the correcting cylinder in the trial frame (or phoropter) and also in the finished spectacles. As mentioned previously, Neumueller[61], O'Shea[58] and others have recognized this factor and have compiled tables for the correcting cylinder when the vertex is placed about 15 mm. from the cornea. While it is true that the trial frame or phoropter cylinder usually is 15 mm. or more from the cornea, spectacle lenses are seldom worn so far out.

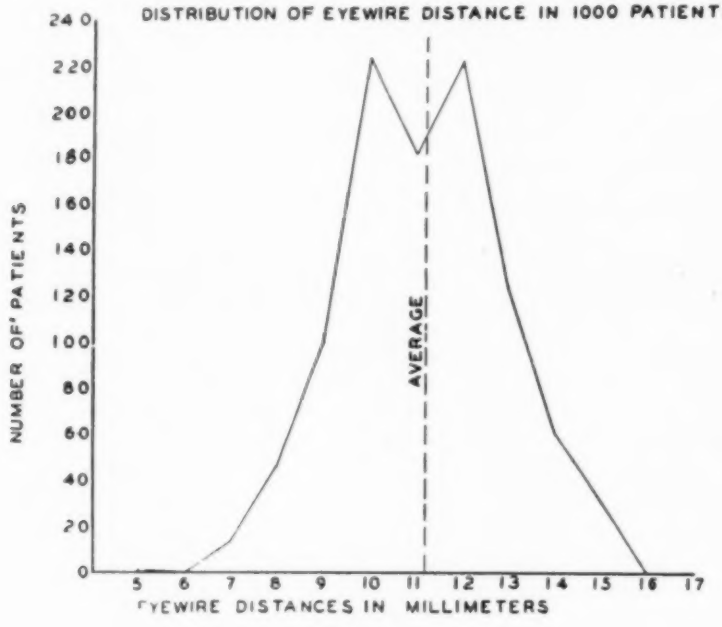

Figure I

In order to obtain an idea of the average distance that spectacle lenses are worn from the apex of the cornea we have measured and analyzed 1,000 cases (See Table II) and have found that the average distance, eyewire distance, is 11.2 mm. By eyewire distance is meant the distance between the apex of the cornea and the center of the eyewire or bevel of the patient's spectacles. In each case this distance was measured for

both eyes with a Wesley-type keratometer which is simply a tube having a millimeter scale at the focal plane of a plus lens (a telecentric system). This convenient instrument avoids the parallax that one is apt to encounter using a millimeter rule held against the patient's head.

TABLE II

Distribution of eyewire distance in 1,000 patients

Millimeters	Number of Patients	
5 mm.	1	
6 "	0	
7 "	13	
8 "	46	
9 "	100	
10 "	223	
11 "	181	*Mean* 11.2 *mm.*
12 "	221	
13 "	122	
14 "	60	
15 "	32	
16 "	0	
17 "	1	
TOTAL	1000	

It is general knowledge that as plus lenses are moved further away from the eye their effective power is increased. That is, a weaker plus lens can be substituted for a stronger plus lens if the weaker one is placed farther from the eye and both will still have the same effect at the eye. Of course, this is applicable also to cylinders; i.e., while dealing with plus cylinders, the farther out we place the lens from the apex of the cornea, the weaker will be the cylinder required to correct a given astigmatic error. The opposite is true for minus cylinders.

Perhaps not so generally recognized is the fact that the spherical ametropia associated with an astigmatic correction influences the effectivity of the cylinder, as the lens is displaced axially nearer or farther from the eye. This explains the apparent contradiction that arises when attempting to apply the rules given above to ophthalmometric readings. To clarify: suppose the ophthalmometer reads 43 D. in one meridian and 45 D. in the other. This astigmatic difference can be expressed either as a +2 D. cylinder or a —2 D. cylinder at different axes. If we consider the +2 D.C., offhand one would say that as the correction will not be at the corneal plane, but farther out, a plus cylinder of less than 2 D. will be required to correct for the corneal astigmatism. But, according to the same reasoning, in the latter case a minus cylinder of more

than 2 D. is required! We all realize, however, that this is absurd and that the sign of the correcting cylinder has no effect whatsoever on its amount. The flaw in the above reasoning is that we neglected to consider the spherical element in the correction. The laws of transposition specify that when the same prescription is written in plus and in minus cylinders, the *amount* of the cylinder in both cases will be the same, but the *amount* of sphere has to be modified by a quantity equal to the size of the cylinder. For example: +1.00 D.S. ⊃ +2.00 D.C. × 90 = +3.00 D.S. ⊃ —2.00 D.C. × 180. In general, in cases of hyperopia, the correcting cylinder for a given amount of astigmatism will be less, the higher the plus spherical component of the correction and the farther the lens is from the eye. In cases of minus corrections the opposite is true.

Let us consider some extreme examples to make this point clear. What will be the cylinder required to correct for a given amount of astigmatism at the corneal plane when associated with different amounts of spherical ametropia and when the spectacles will be placed at various distances from the cornea? The following table gives the power of the cylinder required to correct for 2 diopters of astigmatism (at the corneal plane) when combined with a +10 D.S. or with a —10 D.S. placed at 15 mm. or at 5 mm. from the cornea.

TABLE III

Variations in the cylinder required to correct for two diopters of astigmatism at the corneal plane.

Spherical Component	Distance from Cornea	
	15 mm.	5 mm.
+10 D.S.	+1.42 D.C.	+1.79 D.C.
—10 D.S.	+2.59 D.C.	+2.13 D.C.

This is an explanation for the well known fact that in cases of aphakia, the cylinder determined subjectively is usually lower in amount than the one determined by the keratometer. Therefore, considering ophthalmometric determinations of the astigmatism, in addition to other factors of interpretation, one must allow for the fact that the amount of cylinder is dependent on the distance it is placed from the eye and on the amount of sphere that accompanies it.

RETINOSCOPY

The other common objective way of determining astigmatism is by retinoscopy. Retinoscopy as well as ophthalmometry has some lim-

itations. It is obvious that it is highly desirable to use the retinoscope along the visual axis of the eye being tested. To achieve this, the patient's view of the distant fixation target is usually obstructed and it is therefore necessary to "scope" a little off the visual axis. However, in the usual case where the patient is fixating with one eye, while the other is being retinoscoped, the deviation from the patient's visual axis is very small. But how much difference does this make? First of all, we are measuring the refraction along an axis and for a part of the retina that is usually not utilized in seeing. We would have to be on the exact line with the macula to overcome this factor. Secondly, there is introduced some astigmatism by oblique incidence.

In an attempt to obtain some idea of the amount of astigmatism introduced by oblique incidence when, for example, one retinoscopes an eye 5° off the visual axis we might employ the approximate formulae for a single spherical refracting surface or an infinitely thin lens which were used by Morgan, Mohney and Olmstead[66] to show the astigmatism introduced by the rotation of the crystalline lens around a vertical axis. A sphere tilted[67] or rotated acts as a sphero-cylindrical lens, the cylinder component having the axis parallel to the axis of rotation. Emsley and Swaine[68] say about this:

> "The astigmatism is caused simply by the obliquity of the incident light relative to the lens. If the tilt be represented by θ, and the power of the sphere by F, then the powers of the resulting sphero-cylinder may be calculated from the approximate expressions:
>
> $$\text{Sphere} = F\ (1 + 1/3 \sin^2 \theta)$$
> $$\text{Cylinder} = F \tan^2 \theta.$$"

If one tried to apply these formulae to an eye undergoing retinoscopy, some startling results would be obtained. As an example, consider that the incident beam is 5° off axis (at the conventional working distance of 2/3 meter, this would mean a lateral displacement of only about 6 cm. or 2¼ inches).

Using Gullstrand's[50] value of F in the unaccommodated emmetropic eye as 58.64 we obtain for the sphere:

$$\text{Sphere} = 58.64\ (1 + 1/3 \sin^2 5°) = 58.79 \text{ D.}$$

The error introduced in the spherical component is (only) a little over 1/8 D.

The cylindrical error introduced would be:

$$\text{Cylinder} = F \tan^2 \theta = 58.64 \ (\tan^2 5^\circ) = 0.45 \text{ D.}$$

Thus, it would seem as if an error of approximately 0.50 D. Cyl. against the rule is introduced by retinoscoping an eye 5° off the visual axis (horizontally). However, neither we nor Morgan and his associates have any right to apply formulae for infinitely thin lenses to a problem which is definitely not one of thin lenses. The results are not only wrong but, more important, they are misleading. The only thing to be ascertained by putting F = 58.64 D. in the above formulae is the astigmatism of a narrow bundle of rays refracted by a single spherical surface or thin lens whose refracting power is the same as that of Gullstrand's schematic eye. However, with respect to the human eye which is not a single refracting surface nor even a centered optical system the above results mean nothing except perhaps an intimation of the nature of the problem. Southall[51] provides correct formulae for calculating the astigmatism of a narrow bundle of rays incident obliquely on a centered system of spherical refracting surfaces such as a schematic eye but as he, himself, states[69]:

> "There is absolutely no sense in talking about 'oblique incidence' on a schematic eye. A schematic eye is a purely mathematical eye applicable only to direct incidence (paraxial rays, and no others). You can make calculations if you like and determine the astigmatism of this mathematical eye, but the calculations have not the slightest bearing on any problem connected with a human eye."

A comprehensive study of the location of the primary and secondary astigmatic fields of the human eye in cases of oblique incidence was made by Ames and Proctor[70] in 1921. They measured an astigmatism (due to oblique incidence) of about ¼ to ¾ of a diopter as the test object was moved from 5° to 20° from the visual axis. They also presented a summary of most of the previous studies that had been made on astigmatism by oblique incidence since the investigations of Thomas Young. Among other things, Ames and Proctor conclude that the astigmatic fields on the nasal and temporal side do not lie in the same position relative to the retina. This might be due to the fact that the visual and optic axes of the eye do not coincide.

Our clinical experience has been that an error of almost a half-

diopter of astigmatism against the rule is introduced by retinoscoping an eye 5° to 10° off the visual axis. This error is noticed particularly if the examiner does not change his position in scoping both eyes of the patient: that is, if he uses his *right* eye to scope the *left* eye of the patient. The only clinical reference that we have been able to find on the effect of oblique incidence in retinoscopy has been by Pascal[43] who states:

> "In order that the patient might see it [the target] at all times, the examiner must work oblique to the patient's visual line . . . This obliquity of observation in retinoscopy has made accurate retinoscopy impossible. For the obliquity introduces anywhere from 0.50 D. to 1.00 D. of false astigmia in addition to various disturbing aberrations due to obliquity."

Another source of confusion in retinoscopy is the effect of spherical aberration. In most eyes, but especially in those with a large pupil, there is a difference in the refraction as determined by the retinoscope between the peripheral and the central area of the pupil. It is usually advised to neglect the peripheral reflex and consider only the central part, because the central portion of the bundle is the one utilized in vision.

In dynamic retinoscopy the refractive condition can be measured more nearly along the subject's visual axes, thereby reducing the possible error due to obliquity of observation that is encountered in static retinoscopy.

Sheard[71] has mentioned a factor which should be considered when attempting to interpret dynamic skiametry findings. This is:

> "The possibility of accommodative astigmatism, demonstrated by the fact that the astigmatic corrections at short fixation distances exceed those at twenty or more feet by from one-half to three-quarters of a diopter."

It should be realized that the effectivity of lenses used in refraction varies with changes in fixation distance. This fact explains some of the differences found between the astigmatic component measured when the patient's fixation is changed from distance to near. Furthermore, the fluctuations of the accommodation and the convergence during dynamic retinoscopy may make it difficult to determine in some cases the exact amount of the astigmatic component. Variations between the static and dynamic retinoscopic and subjective findings may be due

to still other factors, such as the size of the pupillary apertures during the various tests and also the very likely possibility that the patient selects (subjectively) different sections of the ray bundles when he is instructed to *fixate* or to *focus* or to *read* letters. As Lancaster[68] says:

> "Any objective test, even so valuable a one as retinoscopy, can give only rough approximations, since . . . only the person being tested can tell what point in the ray bundle suits him best, gives him the most serviceable images."

Ophthalmometry and retinoscopy in the *objective* measurements of astigmia should be appreciated for their importance as valuable guides. We do not feel that these two tests alone are adequate or sufficiently exact to warrant prescribing for most patients without recourse to some form of subjective verification or modification*.

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DISCUSSION

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It is a privilege and a pleasure to lead a discussion of a paper composed so diligently and intelligently as that "On Astigmatism" by the Fellows Bannon and Walsh. In the discussion I shall follow the outline of the paper.

In the first part, the authors compute the errors of keratometric readings introduced by a change of the corneal index and we are informed that this error is small provided the assumption of equal toricity of the anterior and posterior surfaces is true. It would be of value if a gifted experimentator would devise means to measure the curvatures of the posterior surfaces of many corneas and so produce a basis for this assumption.

The authors then present an original way of determining the residual astigmatism in aphakic eyes fitted with contact lenses. This new idea opens a fertile field for investigation. There seems, however, to exist one difficulty and that is to isolate the distorting effect of cicatrization due to the preceding surgery. Table I shows five out of eight cases to have astigmatism against a rule on the posterior surface of the cornea. We agree with the authors' opinion that it would be premature to consider this fact to prove that the posterior surface of the cornea is the seat of the physiological astigmatism. It is well known that the majority of aphakic eyes show astigmatism against the rule of medium to high amount which is generally attributed to the cicatrization after the operation. I hope that the authors' appeal for cooperation to all practitioners fitting contact lenses will find a ready response. It might also be of value to record the corneal curvatures before the operation. This may give us a clue concerning the amount of astigmatism caused by the operation.

Next the authors discuss the influence of the position of the prescription lens in front of the cornea. In 1929, when I wrote the original article on this subject, I did choose 15 mm. as the distance between cornea and lens because this number was more convenient for computations. I suppose all the later writers using my tables did leave this distance unchallenged in order to avoid additional computing work. I grant that this distance is too large. However, as Drs. Bannon and Walsh point out, a few millimeters do not bring about significant changes. The authors point out very correctly the absurdity of promoting a rule based solely on the power of the cylindrical power of the correction. I hope that this paper will achieve what I failed to achieve during the last fifteen years, namely that this rule will be rescinded.

The next ocular body which may cause additional astigmatism is the crystalline lens. The obliquity of the visual axis should have no effect upon the astigmatism as found subjectively and retinoscopically provided the latter test is performed along this axis. I shall talk on this point later on.

Concerning the existence of meridional compensatory, lenticular astigmatism, there is not a shadow of a doubt that it does exist even to the extent of 2.00 diopters. Any practitioner frequently has occasion to observe this phenomenon. The argument concerning the lack of a neuro-muscular apparatus to explain the phenomenon reminds me of the story of the lawyer visiting his client tells him most emphatically "They can not put you in jail for that," to which the client sadly replies, "Maybe not but here I am."

In the next section the authors discuss the errors which may be introduced during the retinoscopic test. They maintain that a false astig-

matism is introduced because we do not test along the visual axis. In spite of the age of this objection, I cannot agree with it. If static retinoscopy is practiced the way it should be, namely using the right eye to test the patient's right eye and the left eye for his left, we are absolutely able to retinoscope along the visual axis. In spite of my racially anthropological handicap, the measurement from my eye to the outside of my ear is not more than 45 to 50 mm. Discounting any lateral phoria of the patient, I have no difficulty whatsoever to retinoscope along the visual axis as long as the interpupillary distance is not less than 50 mm.

The argument advanced by the authors is more applicable for dynamic retinoscopy. In order that binocular fixation can be maintained during the test, all dynamic retinoscopes have their points of fixation 1½ to 2 cm to the side of the axis of the instrument. When the retinoscope is used at 13 inches, as in Tait's technique, we introduce an obliquity of about three degrees.

In closing my remarks, I would like to call attention to one important factor, namely, the repeatability of the keratometer readings. The seniors of the Pennsylvania State College of Optometry serving as interns in the clinic have to complete certain assignments on instrument techniques outside of their regular clinical work. As far as the keratometer is concerned, they have to make for twenty consecutive clinic days two readings with each of the three ophthalmometers on eight subjects. After they are finished with this assignment, they have to submit a graph showing the scattering in power and in axis for each of the three instruments and for each of the eight subjects. In general the average deviation of the reading power does not exceed .25 to .37. This deviation remains almost constant regardless if the cylinder be high or low. The scattering of the axis readings is much larger for smaller cylinders than for higher. In cylinders of .25 or .50 diopters, it may well reach ten degrees. Incidentally, the readings as obtained by the instruments of the three different manufacturers are quite comparable.

NOTES ON THE TECHNIQUES USED IN THE CORRECTION OF SQUINTS*

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In the interest of clarity, first of all I will classify the convergent squints in the following manner: Latent hyperopic type, spastic (where the squinting eye is on the side of the handedness) and the alternating.

The *latent hyperopic* type of squint is that type where the squinting eye is on the opposite side of the handedness and where the dynamic skiametry is usually within one diopter of the static net. It is with this type of case that we enjoy our greatest success, for the majority will respond to plus and an early cosmetic improvement is noted. In this type of case we can usually crowd on from one-half to a diopter more plus than is found in the subjective and the patient seldom ever complains or reports blurring, and regardless of how much drop in acuity the extra plus brings about, when they return for their progress report they nearly always have maximum acuity and considerably more plus is manifested and accepted both objectively and subjectively. By the time we reach the limit in plus acceptance we will generally experience a perfect cosmetic result. In nearly all of these cases we find the squinting eye is amblyopic and complete occlusion of the dominant eye is recommended upon the completion of the examination. In the case of infants or preschool children we insist upon complete occlusion until the correction is delivered, at which time the corrected acuity is again recorded. If acuity is still sub-normal, then the opaque occluder is provided and recommended for as nearly constant wearing over the dominant eye as is possible. We make it a policy that all squint cases return every thirty days for a progress report. As fast as more plus is accepted so long as esotropia or esophoria is present we continue to increase it. When we have reached our limit in plus acceptance, visual training is encouraged. If the patient is one too young to begin training (we never start any patient before age seven) and there still remains suppression or suspension depending upon the age of the patient we do one of the following: In a preschool aged child we paint the nasal one-third side of each lens with some form of red paint, increasing this every couple of weeks until we are about one-sixteenth of an inch from P.D. centers. In older children

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or adults we recommend the wearing of a red occluder alternately thirty minutes of each hour; that is, fifteen minutes on each eye. If the patient is unable to get in for visual training and after maximum acuity is obtained in each eye with maximum plus, then we recommend bandaging or complete occlusion of each eye for one week, until each eye has been completely occluded for two full weeks. The purpose of this is to enable the patient to build maximum monocular skills and then we encourage the use of stereoscope.

Spastic squint—squinting eye on side of handedness. A much smaller percentage of perfect cosmetic results is realized in this type of case, even though they be of the latent hyperopic type. In the squinting eye maximum plus with a slight over correction is prescribed and in the dominant eye whatever is found in static skiametry we prescribe an additional plus 2.50 in order to completely blur out the dominant eye, forcing the individual to assume dominancy in the squinting eye for all uses except near point where the individual will again use what he has established as his dominant eye. The purpose of this technique is to completely inhibit accommodation and as early as possible establish dominancy on the side of handedness. Squint will generally be more marked temporarily using this method than if we allowed dominancy as established to remain. This, of course, is another way of getting maximum acuity in the squinting eye if amblyopic at the start. After maximum results are had from lenses, then visual training is recommended and if possible instituted. If not, the same procedure is recommended as in the first case.

Alternating type. In this type, maximum plus is prescribed with complete occlusion for one week alternately until normal or maximum acuity is obtained, after which an extra 2.50 of plus is prescribed for the eye on the opposite side of the handedness. After which, full plus is prescribed for both eyes and visual training instituted and either red occluders worn alternately fifteen minutes on each eye or the red paint is used on the patient's lenses.

In all three types of cases where we find the dynamic skiametry finding gross is upwards of one diopter in excess of the static net we have found from experience that any plus in excess of the subjective is not worn comfortably and like the typical B 2 type case reports and complains about blur in distance. The difference between the dynamic gross and subjective is always prescribed as an add for near point use. Unless bifocals are prescribed seldom ever are any satisfactory results obtained.

Naturally, very much the same procedure is followed in these cases as has been explained earlier.

Being especially interested in squints for many years, I have watched them rather closely and find that after fusion and stereopsis have been established over a period of time certain of these cases will demand less plus as time goes on to the point where some who will wear as much as a plus 3.50 diopter may so completely rehabilitate that no plus is accepted either objectively or subjectively for distance use, while others may always remain fixed.

In cases of children where the parents are concerned about the child wearing glasses and express a desire that the glasses be dispensed with for general wear if possible, we do the following: After a high degree of fusion and stereopsis have been established we prescribe the minimum amount of plus that will give a good 20/20 or maximum acuity in each eye and prescribe as an add for reading the difference between that and the near point net, and periodically as discretion and safety dictate we continue to reduce the plus in the distance correction until such time as a perfect result is obtained and maintained without any correction for general wear. When this has been accomplished our case is then completed and we feel that the objective has been obtained. In all cases where bifocals are prescribed according to the procedure herein outlined we seldom ever find the patient inconvenienced or complaining about wearing bifocals as these individuals do not experience the same unpleasantness from bifocals that a presbyope does.

Divergent squints. In all cases of divergent strabismus we give minimum amount of plus and maximum amount of minus, and in the emmetrope or slight hyperope we crowd on all the minus that the amplitude of accommodation will carry, regardless of the kind of acuity obtained. The purpose of this is to establish as quickly as possible a conditioned response between accommodation and convergence. The occluding as outlined as previous procedure is followed out in this type of case also, again making sure that dominancy is established on the side of the handedness. If red paint is used on the patient's lenses, then it's the temporal one-third of each lens that is covered, increased toward the centers within the limits of the P.D. or the alternate red occluder. Since we work on voluntary muscles in divergent squints we can generally expect a more satisfactory result, especially if dominancy is on the side of the handedness. Maximum minus is worn until such time as fusion is established and the near point net is less than is being worn. As fast as the near point net minus projection is reduced so is the lens correc-

tion. In all divergent cases we encourage visual training at the earliest possible moment, rather than waiting to get maximum results from the lenses. Very often the maximum amount of minus that the amplitude of accommodation will carry will bring about an immediate cosmetic improvement and in some cases a perfect cosmetic result. In those cases where the amplitude is low and will not carry all of the minus we would like to prescribe for general use, bifocals are prescribed—prescribing the weakest possible add that assures an equalization of fatigue in the two reflexes.

Since the writer has no way of knowing how many of his readers do visual training and how familiar they are with different instrumentation, I shall simply say that in our office we follow the Graduate Clinic Foundation technique literally and have the following instrumentation:

The myologic unit for developing motility excursions, versions and good reciprocal inervation between each pair of extrinsic muscles, this being done monocularly. Diplopia training for five or ten minutes on squint corrector using vertical prisms. Rotoscope for breaking up suppression and developing fixation, using a certain few of the targets that are supplied with the instrument. Chieroscopic drawing to develop kinesthetic reflexes, coordination between eye and hand. The patient is moved again and placed before the Tel-Eye-Trainer. We use arrows at the start—if a convergent squint, pulling the eyes outward; if divergent, the arrows then are placed close together pulling the eyes inwardly and this, of course, is done with lights flashing alternately, using a rotor that produces a fairly rapid flash, speeding it up as freedom of movement is improved. Then the set of cards, known as the suppression series, is used with a more rapid flash alternately. Then a special set of cards used principally for suppression cases and amblyopia using a 1-2-3 flash alternately and then on binocularly. This generally takes about one hour and then the case is dismissed for that day.

No binocular training is ever given in any visual training case until all of the monocular skills have been satisfactorily established. In a case of squint, no binocular specific training is ever given until a reasonably high degree of fusion has been established, except to give them the binocular flashing with the red and blue plain cards without lens correction. This is what is known as the Lang method of fusion training in squint cases and demands only the poorest and lowest type of fusion. This is done after all of the other things have been given and the patient has been allowed a rest period. This is to be done for at least thirty minutes. We like to see squint cases every day if possible, if not, then

the minimum number of visits that we allow are three times a week. If the individual can not get in at least that often, then we simply recommend home training. In all cases after suppression has been broken down and some degree of fusion has been established we recommend a stereoscope, using Keystone base-in and base-out series for home training, along with the right and left suppression cards, known as the P G series.

DR. J. A. SEIFERT
EATON TOWER
DETROIT, MICH.

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MOBILIZING THE FORCES OF ETHICAL PROFESSIONAL OPTOMETRY

This is a call to arms just as imperative to the future of our profession as is the service of your boy and mine to the country we love and to the other freedom loving or seeking countries the world around.

Nothing worth while ever was achieved by sitting around waiting for something to happen.

We used to regard Lincoln as in a class by himself and in many particulars he was, but in his devotion to freedom it would seem that Washington had more to lose and less to gain by giving up the easy

affluence he well might have enjoyed for the hardship and suffering of grim warfare.

Washington at Valley Forge stands to us as an everlasting symbol of self-sacrificing devotion to an ideal.

Presumably your fellowship in the American Academy of Optometry indicates that you have been reasonably successful in your practice. Also it may be taken to indicate your approval of professional ethics and ideals.

At this critical hour something more is necessary.

The next five years well may determine the future of optometry for years to come or for all time.

During these war years optometrists in the Armed Forces have been discriminated against by those in authority who in spite of their high position are not free agents but whose actions of necessity must conform to the desires of the most powerful professional group in the country without whose approval, implicit or explicit, no Surgeon-General could hope to succeed in his colossal task.

Articles such as a recent one by Conrad Berens, M.D., make us doubt the claim that commercialism or lack of approved educational standards or facilities are the real reasons for denial of commissions to optometrists. The reasons advanced are camouflage but not withstanding we are not so naive as to deny there is much room for improvement in some of these things.

However, there can be no denial that the training of the present day optometrist is incomparably superior to that of the refracting physician and certainly no optometrist possibly could be commercial while in the service of his country. Dr. Berens' article previously alluded to testifies to the high quality of the service rendered by optometrists in the Armed Forces.

Optometry's future is in the hands of the American public. Academy standards are the ultimate guarantee of that future.

Medicine is on the defensive. The public has made its wishes known in no uncertain terms. Socialization of health care is an imperative demand. Medicine continues to side step. The public has asked for bread. The medical profession offers a stone.

Socialized health care is here for many millions in the Armed Forces and their dependents. Much more is on the way. It is not an

attempt of politicians to regiment anyone. It is the result of an irresistible pressure.

Widespread legislation is imminent. We cannot conceive that advertising physicians, dentists or commercial spectacle vendors will have any place in the new scheme of things.

Unfortunately our local, state, and national optometric associations have not been sufficiently discriminating to put the mantle of professional virtue upon the shoulders of their heterogeneous membership.

It is a tragic situation but it is useless to ignore facts unpleasant though they may be.

A higher standard is essential and urgent. The Academy offers that standard but the Academy lacks numbers sufficient to command respectful attention.

The conclusion is inescapable. We must greatly increase our numbers and do it quickly. There must be no letting down of standards to achieve this result. Along with it must go Herculean efforts to raise the entire level of optometric standards and practice. There can be no half measures.

At the very least the year 1945 should see our membership doubled. Further it must be an active membership that will command regular attendance of all the Fellows and maintain a constant educational program and so conduct its affairs that throughout the length and breadth of the land men in our own and kindred professions shall recognize Fellowship in the Academy as the sure sign of competency and integrity.

We must make Fellowship in the Academy a mark of distinction sought and prized by the best men and women in our profession.

Obviously this requires a new orientation. It cannot possibly achieve the desired vitality and influence if it is to remain largely a passive organization consisting essentially of a few officers, however devoted, who correspond voluminously during the year and annually meet for two or three days to hear and read papers and elect officers.

All these things are excellent in themselves but insufficient.

The only solution to this urgent problem is widespread organization of local chapters. Active chapters. Active educationally—constantly striving to elevate the Fellows by bringing in recognized authorities in allied fields: medicine, physiology, psychology, parasitology, education, physics, sociology, etc., etc.

Every community big enough to support one or more institutions of college grade, and their number is legion, can furnish a continuing program of education, real education.

Without wishing to set up the Los Angeles Chapter as a criterion, its programs over the past several months show possibilities which may be duplicated and improved in fifty, possibly a hundred and fifty centers up and down the country. One difficulty is in securing in some of these areas enough Fellows who can meet Academy standards. Experience shows that numbers of excellent men need only a little pressure to induce them to make necessary changes to conform to our standards.

Our colleagues in Berkeley, Columbus, New York, Philadelphia, Cleveland, Boston, Rochester, Detroit, Toronto and many other centers can develop programs using the talent at hand and assisting in cultivating latent abilities.

Possibly we in Los Angeles have over-emphasized related fields to the neglect of our own, but to some extent that is due to paucity of real scientific material in optometry although we feature as a rule a thirty minute review of papers or of one paper appearing in our American Journal of Optometry.

We hail with satisfaction such work as that of Morgan and Stoddard at Berkeley, of Fry and Hoffstetter at Ohio, of Treleaven, Fisher, and Brock of Columbia and of others hither and yon, all of which indicates the dawning of a new day in our profession in which the empirical shall be subjected to scientific analysis and optometry shall adopt the scientific method of controlled research and widespread publication of results.

Such work and such methods are long overdue in optometry but they will pay handsome dividends. The Academy has helped in this development but it can do immeasurably more if expanded to take in the really sincere ethical men in our profession. The local chapter is the mechanism which best can bring about this urgent mobilization of our forces.

All present members of the Academy are urged to get together a small group of the most ethical, most influential of their professional colleagues and impress upon them the urgency, the opportunity, and the high privilege of leadership in a movement to guarantee the future of our profession as an instrument of bringing to humanity a service of real merit. Together let us work and plan that the very mention of optometry shall arouse feelings of gratitude and satisfaction.

In conclusion the writer lists a few of the values attaching to maintenance of a Chapter of the American Academy in your area. Others will occur to you.

(1) It is a necessary and valuable channel through which shall flow a constant stream of influence for the upbuilding of the highest quality of ethical and technical skill among the practitioners of optometry.

(2) Serving this purpose will be scientific papers of real worth delivered in person by leaders in optometry and in related fields of medicine, physiology, psychology, education, etc., etc.

(3) The reflex effects upon these leaders of contact with a group of highly intelligent, ethical practitioners of optometry and with leaders of scientific thought in optometry.

(4) The benefit accruing to our own Fellows as they prepare and present papers and the broadened culture resulting from continuance of such regular programs.

(5) The opportunity of bringing in to our meetings of key personnel as guests—notably those who are opinion molders; university faculty members and administrators, physicians in good standing with their own group and others who for one reason or another might be interested in the program presented.

(6) The privilege of meeting in an organization which concerns itself solely with cultural values and not at all with fees and economics which have their place but not in an academy.

(7) Add your own concept of values to be achieved, one of which probably will be the reflex effect upon the entire profession.

ERNEST A. HUTCHINSON.

TOO OLD TO LEARN?

It has often been said that "You can't teach an old dog new tricks." A professional man who has been in practice for some time may hesitate to undertake new techniques or to master new instrumentation. Subconsciously he feels that he is "too old to learn"; he feels that he has passed the ideal age for learning and allows his mental growth to retard itself or stop.

The greater the background of experience the easier it is to understand anything. A beginner in optometric studies has nothing to which to relate his thinking. But one who has been in practice for some years

has a greater foundation upon which to evaluate and correlate his studies. The more we know the easier it is to learn more.

We are too prone to believe that the mind slows up when body activities do. Because we can't run as fast as we used to run we automatically think that our minds can't work as efficiently as they once did. But is that true?

Definitely not! A mind may slow down from lack of exercise and sufficient use. Mental faculties do not fatigue like an arm or a leg. It has been said that the energy contained in a single peanut is sufficient to supply all of the strength the mind requires for hours of concentrated mathematical calculations. Mental faculties do not need rest as the body does; apparently they need very little sleep.

Dr. E. L. Thorndike of Columbia University has conducted many experiments to determine the ability of middle-aged and old people to learn. He gave them mathematical problems and also the problem of mastering a new and strange language. In all these experiments he found that the oldest learned nearly twice as rapidly as the youngest groups. Learning ability should, and does, increase with age.

We don't stop shaving when we reach fifty; we don't stop bathing when we reach sixty; nor do we stop eating when we enter middle-life. We continue to care for the body. Why not continue to devote attention to our mental growth for it is the Mind which manages the art and craft of living?

LAURENCE P. FOLSOM.

SPECIAL REPORTS

THE MAKING OF AN OPHTHALMOLOGIST*

A REVIEW OF A PAPER BY CONRAD BERENS, M.D.

Arthur E. Hoare, O.D., F.A.A.O.
Los Angeles, Calif.

This review of Dr. Berens' paper is one of the most pleasurable tasks I have undertaken in now over two decades of more or less intensive consideration of the problems explicitly dealt with and implicitly hinted at within the terms of the paper.

This assignment is more than pleasurable: it is deeply satisfying, because of its sheer importance—for in it may be clearly seen the deep and clear reasoning of a great leader, as also the warm and practical attitude of the scholar and true physician. I take Dr. Berens to be a man whose basic attitudes take cognizance of the reality of the situation—as it concerns the two main groups concerned, as also that of the public at large in whose interests the two groups are pledged to consider all problems involved.

Dr. Berens is a leading American ophthalmologist—practitioner—teacher—writer, and molder of medical sentiment. He read this paper as Chairman of the Ophthalmological Section of the American Medical Association on the occasion of the last meeting of the Section this past summer.

The paper thus becomes a document of authority and sets a standard for further consideration of a mutually vexatious problem—and brings the whole matter of eye service above the level of narrow prejudice and into the broader and brighter area of frank and forward looking study.

I am sure neither Dr. Berens nor his colleagues would consider it an impropriety that we—a group of optometrists—should be seriously studying and evaluating this paper on "The Making of an Ophthalmologist."

Optometry is more than academically interested in the subject under consideration.

As one of our contemporary optometrical journals says, "The post war effects on optometry cannot be fully foreseen. But we can note certain trends that may help to guide and stimulate our motives today, so as to be better prepared for the next few years, at least. One trend for optometry to be alert to is the trend in ophthalmology. What is this profession thinking and doing for improvement in the educational field? Call this a contemporary trend if you wish, because the optometrist will be evaluated by such a comparison."

It would appear to me that it is axiomatic that optometry should continue to develop as a *legally* independent group in the field of public health. At the same time, it would appear to be equally axiomatic that opportunity must be provided for ophthalmology and optometry to

*An abridgment of the material presented before the Los Angeles Academy of Optometry, December 8, 1944. For publication in the April, 1945, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

enjoy, to a greater degree than heretofore, the fruits of inter-dependence. In a bargain of this kind ophthalmology has nothing to lose, and can well afford to be generous in its attitude. Optometry, too, must be willing to share in the self discipline incidental to such educational, economic, and ethical inter-dependence.

Coupled with this review it might not be irrelevant to refer to the publication by the American Medical Association in the Journal of July, 1944, of notice of post-graduate and refresher courses in ophthalmology. This matter is rather fully presented in the Optical Journal and Review of Optometry, November, 1944, issue.

Dr. Berens begins his paper by stating that in guiding the medical student who desires to practice ophthalmology, emphasis should be laid on (1) education; (2) ethics; (3) research and importance of attending medical meetings.

Under education, Dr. Berens deals at length with what he regards as essential in the educational training of the young ophthalmologist.

I was particularly struck by the reference to the non-profit home study courses, sponsored by the American Academy of Ophthalmology and Otolaryngology, under the direction of Dr. Harry S. Gradle.

I am sure it would be enlightening to optometrists to be presented, at some later time, with a brief account of the founding and development of the National Board of Ophthalmology, together with the history of the other specialty boards in the field of organized medicine in America.

In reading over the rather formidable list of subjects, courses, etc., being proffered in the training of ophthalmologists, I am rather forcibly reminded of the contrast which exists in the comparison of these facilities with those which I found listed in the official bulletins of medical schools in the early 1920's. At that time I made a study of such matters in connection with an attempt on the part of our own National Association to set up an educational council for determining the education necessary in the training of an optometrist. I think, at that time, and in relation to refraction, the prize went to Johns Hopkins Medical School, which provided four lecture periods, two of which were devoted to the study of the trial case and its contents.

Under the division of ethics, Dr. Berens brackets Ethics and Optometry: this association is not without its significance, and clearly points to the fundamental question of interprofessional relationships. I

quote from Dr. Berens' paper, since this section is of special concern to us as optometrists:

"One of the most important problems in ethics from the standpoint of public service and public health is that of optometry. Those who believe that optometrists should be taught certain subjects and that there should be closer cooperation between ophthalmology and optometry are apparently in conflict not only with the Oath of Hippocrates, 'I will impart a knowledge of the art to my own sons and those of my teachers, and to disciples bound by a stipulation and oath, according to the law of medicine, but to none other,' but also with certain resolutions passed by this section in 1936, which were reaffirmed in 1942. I believe this part of the Hippocratic Oath should be reconsidered by ophthalmologists in the light of conditions existing in 1944 and that the entire matter should be returned to the individual state and county societies.

"Some members of the section have said that insufficient consideration has been given to optometry and that the only place where these problems have been discussed has been in the brief executive meetings of the section. These statements have been made without knowledge of the facts, for the Section on Ophthalmology appointed a committee on optometry as far back as 1913, designating Dr. William C. Posey as chairman. This question was thoroughly and ably discussed by Hiram Woods in 1913 and by Walter B. Lancaster in 1928 in their chairman's addresses. Having served as secretary of the American Committee on Optics and Visual Physiology and as a director of the National Society for the Prevention of Blindness, I have gradually accepted the conclusion that lack of cooperation between ophthalmologists and all others concerned with vision and eye health is the most serious unsolved problem in the prevention of blindness today.

"Those who have been closely associated in the study of this problem believe, almost to a man, that optometrists should be taught by those best qualified to teach subjects which would aid in preventing blindness. A recent vote taken by the American Ophthalmological Society and by this section indicates a similar opinion among a large and growing group of ophthalmologists. I believe that a careful unbiased study of the reasons why so many men are now in favor of cooperation, by those who hold opposite views, would lead to a change of opinion in many cases.

"The armed forces have used optometrists under the close supervision of ophthalmologists, and in the great majority of instances of

which I have personal knowledge the arrangements have been mutually satisfactory to the ophthalmologists and to the optometrists. Because of this, ophthalmologists have asked whether a similar arrangement would not be satisfactory in private practice, as this association has also proved useful in some of the nation's municipal and private hospitals. This is one problem a special committee of the American Medical Association might well study to the mutual benefit of all concerned.

"In spite of the existence of the 1942 optometry resolution, we should cooperate in preventing the introduction of bills in our state legislative bodies and the publication of articles in scientific or lay journals which fan the flame of a feud. The feud between the two groups concerned with eye care not only lessens the faith of the public in all types of eye service but also shakes public confidence in medical care in general, because few laymen can define the terms optometrist, ophthalmologist and optician.

"I urge each young ophthalmologist and every member of this section to study this problem from the aspect of public health, service to the public and the prevention of blindness, without prejudice engendered by personalities or by financial considerations."

I think I am safe in assuming that I am expressing, as a member of an academy whose sole aim is the making of better optometrists by education and ethics, the sincere hope that there will be found, in each group, enough men of good will and professional courage to foster and fulfil the hope so eloquently expressed by Dr. Conrad Berens.

PROCEDURE AND INSTRUMENTATION

Rudolph H. Ehrenberg

A department wherein discussions will be carried on relative to the value of various experimental and clinical techniques as employed by practicing optometrists, and also in which the instruments used by optometrists in various phases of their work, will be subjected to some critical evaluation.

VERHOEFF STEREOPTOR

The study of depth perception while not new is receiving even greater consideration the last few years. Especially since the beginning of the war. The word Stereopsis is now meaningful even to a great many laymen. Likewise the optometrist has desired reliable testing equipment of maximum portability. Such instrumentation is available.

Designed by Dr. Verhoeff and known as the Verhoeff Stereoptor, the instrument is marketed through American Optical Company.

Verhoeff's use of variously sized test elements at different distances has introduced an improved principle in stereopsis testing. His method insures that correct judgment shall depend solely upon binocular parallax, and reveals whether a patient has genuine depth perception or is basing his judgment as to the planes of the test elements on their relative sizes. The more distant test elements in the Verhoeff Stereoptor are frequently larger than the nearer so that relative size can have no bearing on correct judgment.

It is proper to expect the subject to judge correctly without the aid of relative size differences because in daily practice he is constantly obliged to do so. On the other hand, if he succeeds under these test conditions, one may be certain that he is relying solely on stereopsis. Contradictory size differences increase the difficulty of judgment, but only to the extent and in the form that such difficulty exists in ordinary vision. Those with adequate perception of binocular parallax can depend upon it, and are not confused by such contradictions.

As an instrument, the new Verhoeff Stereoptor is small, weighing fifteen ounces complete with batteries. An oblong, black bakelite screenplate faces the observer. In its center is a rectangular target window with its long axis horizontal. Through this aperture are viewed, one at a time, the four targets which the observer controls from the back of the instrument. Artificial illumination is provided, but is unnecessary when daylight is available.

Each target consists of three vertical bars of varied sizes one or more of which is affixed to the far side of the slide, the others to the front, with a depth difference of 2.5 mm. between them. Although there are only four targets, by turning the instrument upside down their positions can be reversed laterally, giving eight different tests in all. Because the instrument looks exactly the same to the subject either way the memory factor is eliminated. The face of the instrument is lustreless and all edges in front of the light source are tapered so that no telltale light is reflected to aid him. The various testing positions are keyed on the back of the Stereoptor so that the observer may know which target is being viewed.

The stereoptor is held at eye level height and the test is made at a distance of 1 meter, or closer. Accuracy at 1 meter is rated as 20-20, or

100/100. At other ranges the fractional rating would be the number of centimeters over 100.

The writer does not know if this test correlates with the "Howard Dolman" Peg Test for distance or whether it is intended to. If such data is available it will be carried in a later issue.

VISUAL EDUCATION

A new sound moving picture entitled "To Greater Vision" has been produced by Bausch & Lomb, and is currently being shown throughout the country.

This film stresses the importance and application of optical instruments to health, science, industry as well as other fields. It demonstrates the value of optical glass to America both in peace and war and portrays its manufacture from the raw materials to the finished optical apparatus.

One section is devoted to a graphic portrayal of the action of rays of light as they enter and leave prisms and lenses of optical glass. Thus reflection, refraction, dispersion, and focus are simply explained.

Of interest also to the layman is the technique of an eye examination and the processing of eye wear as well as the necessity of adequate eye aids.

Interested professional and lay groups can arrange for this film by contacting the Film Distribution Service, Bausch & Lomb Optical Company, Rochester 2, New York.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

OCULO-REFRACTIVE CYCLOPEDIA AND DICTIONARY. Thomas G. Atkinson, M.D., Published by The Professional Press, Inc., 5 North Wabash, Chicago, Illinois. Illustrated. 388 pages. Cloth, $3.50, 1944.

The Third Edition of the Oculo-Refractive Cyclopedia and Dictionary has recently made its appearance. This book, originally written approximately two decades ago by Thomas Atkinson, is continuing to serve a useful purpose to refractionists everywhere.

In most fields of technical activity there is a need for a text which defines the particular terminology used by the professions which occupy that field. We find in engineering, dentistry, chemistry, medicine and others, books presenting these specified techniques, formulas, tables and other useful data of value to these particular endeavors and supplying members of these professions with concise information not readily obtainable through the average text.

During the past twenty years Atkinson's refractive dictionary has served the optometric profession in this way, and for the third time the author of this work has brought it up to date. As a refractive dictionary the author has included within its covers only such definitions as those that apply in ocular practice. Other meanings of words used by refractionists found in ordinary dictionaries are not included, as the author has attempted to confine this text to matters having to do with refraction, diagnosis and pathology of the eye as well as matters having to do with physiologic and ophthalmic optics. Many of the subjects are treated by the author in a manner far beyond mere definition. For instance, under the subject of "accommodation" various theories of accommodation are reviewed, the author here presenting a thumbnail sketch of each of these theories, as well as a review of the various phases of accommodative activity and the problems which present themselves to the refractionist when an accommodative abnormality is found.

Under "myopia" the author is found discussing what he calls both axial and functional myopia, and several pages are devoted to his review of this subject. This is true with most of the pertinent headings and is one of the reasons why the third edition of this book is of particular value in a small private library.

Thomas G. Atkinson is well known to the optometric profession. He has appeared on the program at many optometric conventions and through the years has written much that is fine and of value to us all. In this revised new edition the profession is again benefited by his labours and it is hoped that this book receives wide usage. This text is published by the Professional Press which also publishes the OPTOMETRIC WEEKLY. The book may be ordered through any optical laboratory.

CAREL C. KOCH.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

6. OCULAR AND GENERAL PATHOLOGY

FACING THE CATARACT PROBLEM. J. P. Cowen. Sight-Saving Review. 1944, 14, 1, 11-18.

The author reviews the subject of cataract outlining the nature of the defect, its types, signs and symptoms. He then asks when should the operation be advised? His answer is as follows: " The operation is recommended when the better seeing of the two eyes is no longer capable of serving the patient's ordinary needs. Or one hears this rule: remove the cataract when the patient is no longer happy. The practice of waiting until the cataract is 'completely ripe' is definitely a thing of the past; newer methods of cataract extraction have been devised to permit operation at almost any time. However, when a cataract comes to ripening or maturity, even though the mate eye still has good vision, surgery is recommended. Permitting a mature cataract to go unoperated leads to hypermaturity, a state in which surgery is more difficult and in which complications may present themselves which may imperil the health of the eye. When only one eye is operated upon, the patient must be forewarned that a state of rivalry will exist between the operated and nonoperated eyes, and that glasses cannot be given to correct both of them at once. The better eye will be corrected with glasses, and the mate eye will assume a subordinate position. If the patient prefers to use the operated eye, the unoperated or 'spare eye' may be given its own correction in another frame to use at intervals, as a 'matter of practice.' He may be assured that the two eyes, when both have been operated upon, will work well together again."

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